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The Anoplura and Mallophaga of North American Mammals

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I

INTRODUCTION

In the summer of 1913 the junior author, under an arrangement made by the Department of Entomology of Stanford University with Dr. Joseph Grinnell, director of the Museum of Vertebrate Zoology of the University of California, accompanied a collecting expedition of the Museum in Northern California with the privilege of examining for ectoparasites all specimens of birds and mammals taken by the expedition.

Most of the Anopluran material on which this paper is based was derived from this arrangement; but other material already in the hands of the senior author, obtained at various times from mammals taken in California and elsewhere, and certain specimens loaned by Professor Osborn of the Ohio State University and by Mr. Bruce Cummings of the British Museum (Natural History), are included in this paper.

The total Anopluran material on hand includes twenty-two species and two varieties, of which eight species and both varieties are new, and are described herewith. One of these varieties has up to now been considered and listed as a species originally described from European hosts. Only twenty-four species of Anoplura have been hitherto recorded from North American mammals, of which nine are peculiar to North American hosts (as so far known), and fifteen are species originally described from European hosts, or hosts common to both Europe and America. Our list of twenty-two includes fourteen of the twenty-four kinds heretofore listed from North America. The total number of Anopluran species now recorded (including the records in this paper) from North American mammals, is thirty-four species and two varieties.

The total Mallophagan material on hand includes eighteen species, of which one species is new. Twenty-seven species have so far been recorded from North America, of which nine occur on domesticated hosts.

The determination of the hosts of the Californian specimens of Anoplura taken by the junior author in 1913 were made by the wholly competent authorities of the Museum of Vertebrate Zoology of the University of California, and may be implicitly relied on. Great care was taken by the naturalists of the collecting expedition and by the junior author to prevent straggling of the parasites of the collected specimens, and the attributions of parasites to particular host can be confidently accepted.

We desire to express our obligations to Professor Herbert Osborn and to Mr. Bruce Cummings for permission to examine important material kindly sent to California at our request.

The types of all new species described herewith are in the collection of the Entomological Laboratory of Stanford University, California.

II

NORTH AMERICAN ANOPLURA

The systematic knowledge of the North American Anoplura—indeed, of the Anoplura of the world—is still very slight. Although probably most of the species infesting the domestic animals, and certainly all of those infesting man, are known, but few species have as yet been collected from wild animals. At the time of writing this paper only about a hundred species of Anoplura have been described, of which three occur on man and a dozen on domestic animals. The remaining four score have been taken from animals both of wide geographic and wide taxonomic distribution. Monkeys, wild cattle, sheep, goats, deer, elephants, the giraffe, rabbits, rats, mice, squirrels, gophers, shrews, wolves, foxes, wild cats, seals and walruses, of the Old and New Worlds, are represented in the host list, which, however, altogether includes hardly a hundred mammal species. There is no doubt, of course, that many other mammals are hosts of Anoplura; only a beginning in the recording of both parasite and host species has been made.

But this beginning, and the accompanying study of the general biology of the Anoplura and their particular relations to their hosts, both as regards the distribution, the adaptive structural modification, and the physiological fitting of the parasite species and the injury to the host species, have revealed such important problems that the collection and study of the Anoplura is certain to be pursued with an ever increasing interest and ardor.

The special problem of the host and geographic distribution of the Anoplura and Mallophaga of mammals has already been rather fully taken up by the senior author in a paper, "Ectoparasites of Mammals," published in the American Naturalist, vol. 48, pp. 257-279, May 1914, and a special brief discussion of certain significant aspects of the close physiological fitting of the parasites to the specific blood character of the hosts has been given by the senior author in a paper entitled "Ectoparasites of the Monkeys, Apes and Man," published in Science, N. S. vol. 38, pp. 601-602, October 1913.

The comparatively recent determination by the precipitins reactions and by a study of the crystallizable proteins (haemoglobin) of the spe-

cificity of the blood of different mammal kinds, and the physiological (chemico-physical) similarities of the blood of nearly related mammals as contrasted with the dissimilarities of the blood of widely related kinds, finds an interesting confirmation in the very precise host relations of the blood-sucking parasites of the mammals.

As a corollary of this precision of host-relation, there arises the possibility of the determination of the phyletic relationships of hosts on a basis of the identity or close relationship, or the non-identity or wide relationship, of their Anopluran parasites. For the proper following up of this interesting matter, however, a much wider knowledge of the Anopluran fauna is needed.

The importance from the economic and medical point of view of a knowledge of the blood-sucking parasites of mammals is, of course, apparent when we consider the new knowledge of the dissemination (and in some cases, incubation) of various germ-caused diseases. The Anoplura have already been tried and convicted of participation in this crime of aiding and abetting the germs of animal and human disease in their struggle for distribution. And they have been proved to be very suspicious characters, at least, if not yet known to be actual criminals, in relation to their possibility of serving as true alternate hosts of certain dangerous Sporozoa. At least some of these parasitic and disease-producing Sporozoa can enter, remain in, and pass from the bodies of the sucking lice with unimpaired life and virulence.

The Anoplura, then, call insistently for study; and the first need in that study is the collection of material from many hosts and the careful systematic determination of this material. We need to know how many and various are the living species of the group, and the exact facts of their geographic and, especially, host distribution. The present paper is a small contribution along this line.

III

KEY TO THE FAMILIES, SUBFAMILIES AND GENERA OF THE ANOPLURA

1. Occurring exclusively on land mammals 4
   Occurring exclusively on marine mammals (seals, sea-lions and walruses) . Family ECHINOPTHIRIIDAE . . 2
2. Antennae five-segmented, thorax and abdomen bearing scales . . . . . Genus *Antarctophthirus*
   Antennae four-segmented 3
3. Thorax and abdomen bearing scales. Genus *Lepidophthirus*
   Thorax and abdomen without scales . Genus *Echinopthirus*
4. Head much elongated, cylindrical in shape; tibiae without a thumb-like process opposing the claw . . . . . Family HAEMATOMYZIDAE (Containing but one genus, *Haematomyzus,* occurring on elephants.)
   Head not elongated; tibiae with a thumb-like process opposing the claw 5
5. Eyes extremely rudimentary or entirely lacking . . . . . Family HAEMATOPINIDAE . . 9
   Eyes present, well pigmented . Family PEDICULIDAE . . 6
6. Antennae five-segmented (on apes and man) . . . . . Subfamily PEDICULINAE . . 8
   Antennae three-segmented (on monkeys) . . . . . Subfamily PEDICININAE . . 7
7. Legs all of same size . . . . . Genus *Pedicinus*
   Middle and posterior legs larger and stouter than anterior . . . . . Genus *Phthirpedicinus*
8. Legs all of same size . . . . . Genus *Pediculus*
   Anterior legs smaller than the others . . Genus *Phthirus*
9. Antennae five-segmented 11
   Antennae three-segmented Subfamily EUHAEMATOPININAE . . 10
10. Posterior legs with stalked, disk-shaped appendages on femur and tibia . . . . Genus *Euhaematopinus*
    Posterior legs without appendages Genus *Haematopinoides*
11. Anterior legs smaller than posterior . . . . . Subfamily LINOGNATHINAE . . 12

Legs all of same size . . Subfamily HAEMATOPININAE (One genus, *Haematopinus*)

12. Anterior pair of legs with two claws . . . Genus *Scipio*
Anterior legs with but one claw 13
13. Abdomen with well developed pleural plates 16
Abdomen entirely without pleural plates 14
14. Abdominal spiracles large, tubular, projecting from the body-wall . . . . . Genus *Solenopotes*
Abdominal spiracles small, not projecting from the body-wall 15
15. Head usually slender, but little widened behind the antennae, gonapods of female long, frequently reaching beyond the extremity of the body; for the most part infesting Ungulates . . . . . Genus *Linognathus*
Head broad, considerably widened behind the antennae, gonapods very short; infesting rabbits . . . . . One species of the Genus *Haemodipsus*
16. Tergites and sternites of the abdomen for the most part with more than one transverse row of hairs 19
Tergites and sternites of the abdomen for the most part with but one row of spines 17
17. Middle and posterior pairs of legs of equal size, larger and stouter than the anterior pair 18
Anterior and middle pairs of legs of the same size, smaller than the posterior pair . Genus *Enderleinellus*
18. Abdomen with a pair of chitinized plates on the second sternite . . . . . Genus *Fahrenholzia*
Abdomen without such plates . . . . . Genus *Haemodipsus* (in part)
19. Abdominal tergites and sternites with not more than two rows of hairs 20
Abdominal tergites and sternites in part with three rows of hairs . . . . . Genus *Hoplopleura*
20. First antennal joint with a stout spine at the distal postaxial angle or on the posterior margin . . . . . Genus *Neohaematopinus*
First antennal joint not so 21
21. Abdominal tergites and sternites with distinct chitinized plates . . . . . Genus *Polyplax*
Abdominal tergites and sternites without distinct chitinized plates . . . . . Genus *Linognathoides*

IV

DESCRIPTIONS OF NEW SPECIES, AND DETERMINATIONS OF OLD SPECIES OF ANOPLURA

Family PEDICULIDAE

Pediculidae Leach, Zool. Misc., vol. 3, p. 64, (1817).
Pediculidae Enderlein, Zool. Anzeiger, vol. 28, p. 136, (1904).

Body depressed. Head not anteriorly produced into a cylindrical process. Antennae three- or five-segmented. Eyes large and clearly pigmented. Legs fitted for clasping.

This family includes the Anopluran parasites of man and the monkeys, and at present numbers about a dozen species, of which but three—and these the forms infesting man—have as yet been reported from North America. An examination of the monkeys in our zoological gardens would undoubtedly reveal some of the others.

The man-infesting species, *Pediculus capitis* (De Geer), *P. corporis* (De Geer), and *Phthirius pubis* (Linné), are too well known to require discussion here. For a special discussion of the host-distribution of the *Pediculidae* see Kellogg, "Ectoparasites of the Monkeys, Apes and Man," in Science, n. s. vol. 38, pp. 601-602, October 1903.

Family HAEMATOPINIDAE Enderlein.

Haematopinidae Enderlein, Zool. Anz., vol. 28, pp. 136, 137, (1904).

Body depressed. Head not anteriorly produced into a cylindrical process. Antennae three- or five-segmented. Eyes either entirely lacking or very rudimentary. Legs fitted for clasping, the tibiae having a thumblike process which opposes the claw.

This is by far the largest family of the sub-order, including more than three-fourths of all the species described.

Genus **HAEMATOPINUS** Leach.

Haematopinus Leach, Zool. Misc., vol. 3, pp. 64-65, pl. 146, (1817).
Haematopinus Enderlein, Zool. Anz., vol. 28, p. 138, (1904).

Head very broad posteriorly, the temporal angles very prominent, sharp and pointing forward. Antennae five-segmented. Thorax broad,

with well defined sternal plate. Legs all nearly of the same size, and with a strongly chitinized skeletal piece between tibia and tarsus. Abdomen with a swollen, pad-like, strongly chitinized area on the lateral margin of the third to eighth segments. Tergites with many small, chitinized plates or with none at all. Each tergite and sternite with one transverse row of very small hairs.

The genus is for the most part parasitic upon Ungulates. There are but three species recorded from North America, all being from domestic animals.

Haematopinus asini (Linné).

Numerous specimens from a horse, (Stanford University, Calif.); also recorded by Osborn from horses.

Haematopinus suis (Linné).

Numerous specimens from a domestic hog, (Susanville, Lassen county, Calif.); also recorded by Osborn from domestic hogs.

Haematopinus eurysternus (Nitzsch).

Recorded by Osborn from domestic cattle.

Linognathus Enderlein.

Trichaulus Enderlein, Zool. Anz., vol. 28, pp. 139, 141, (1904).
Linognathus Enderlein, ibid., vol. 29, p. 194, (1905).
Linognathus Dalla Torre, Genera Insectorum, Anoplura, p. 12, (1908).

Head more or less slender, without projecting temporal angles; antennae five-segmented; thorax small and elongated; middle and posterior pairs of legs nearly equal in size, larger and stouter than the anterior pair. Abdomen entirely without chitinized tergal, sternal and pleural plates; the body-wall presenting a reticulated appearance. Each abdominal segment with two or three transverse rows of rather long hairs.

The species composing this genus are confined almost exclusively to the Ungulata, one species, however, being recorded from the domestic dog. But four species have been recorded from North America, and all of these are found upon domestic animals.

Linognathus vituli (Linné).

Numerous males and females from cows (Mountain View, Santa Clara county, Calif.). It has also been recorded by Osborn from cattle.

Linognathus stenopsis (Burm.).

We have at hand several males and females, taken from a Mexican goat (San Diego, Calif.), which we are referring to this species. It has not previously been recorded from America.

Linognathus piliferus (Burm.).

We have a single specimen taken from a dog (Stanford University, Calif.). It has been recorded by Osborn from a dog, but is apparently of rather uncommon occurrence.

Linognathus pedalis (Osborn).

Haematopinus pedalis Osborn, Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., pp. 170-172, fig. 99, (1896).
Trichaulus pedalis Enderlein, Zool. Anz., vol. 28, p. 142, (1904).
Linognathus pedalis Enderlein, Zool. Anz., vol. 29, p. 194, (1905).

Recorded by Osborn as having been taken from the legs of a domestic sheep at Ames, Iowa.

Genus **POLYPLAX** Enderlein.

Polyplax Enderlein, Zool. Anz., vol. 28, pp. 139, 142, 223, (1904).
Polyplax Dalla Torre, Genera Insectorum, Anoplura, p. 13, (1908).
Haematopinus (Polyplax) Neumann, Archiv. de Parasit., vol. 13, pp. 529-532, (1909).
Polyplax Mjöberg, Arkiv. för Zoologi, vol, 6, no. 13, p. 159, (1910).
Polyplax Fahrenholz, Reprint from the second, third, and fourth Jahresberichte des Niedersächsichen Zool. Vereins zu Hannover, pp. 29-30, (1912).

Antennae five-segmented, the third segment in the male usually with a pronounced pre-axial projection. Eyes lacking. Anterior pair of legs small, middle and posterior pairs larger, posterior pair usually largest. Abdomen with tergites and sternites well chitinized, and in certain segments transversely divided into two distinct plates; the number of segments thus divided is not constant throughout the genus, and is always less in the male than in the female. Each plate with a transverse row of hairs; pleural plates well developed, present on the first to eighth segments.

The genus is composed entirely of species which find their hosts among the *Muridae*. We are recording two species, one previously described and one new, both from Murids.

Polyplax spinulosa (Burm.).

Plate I, fig. 5; plate V, figs. 11*a* and 11*b*; plate VI, fig. 7; text fig. 1.

Pediculus spinulosus Burmeister, Gen. Rhynchota, no. 8, (1839).
Pediculus denticulatus Nitzsch and Giebel, Zeit. für Ges. Naturw., vol. 23, p. 24, (1864).
Haematopinus spinulosus Denny, Mon. Anopl. Brit., p. 26, pl. 24, fig. 5, (1842).
Haematopinus spinulosus Giebel, Ins. Epizoa, p. 38, pl. 1, fig. 7, (1874).
Polyplax spinulosa Enderlein. Zool. Anz., vol. 28, p. 142, (1904).
Polyplax spinulosa Dalle Torre, Genera Insect., Anoplura, p. 14, (1908).
Haematopinus (Polyplax) spinulosus Neumann, Arch. de Parasitologie, vol. 13, p. 526, (1909).
Polyplax spinulosa Mjöberg, Arkiv. för Zoologi, vol. 6, no. 13, p. 160, (1910).
Polyplax spinulosa Fahrenholz, Reprint from the second, third and fourth Jahresb. des Niedersäch. Zool. Vereins zu Hannover, pp. 30-37, (1912).

One mature female, two mature males, and two larvae of this cosmopolitan, rat-infesting species, from *Epimys norvegicus* (Inverness, Marin county, Calif.), and many males and females from *Microtus cali-*

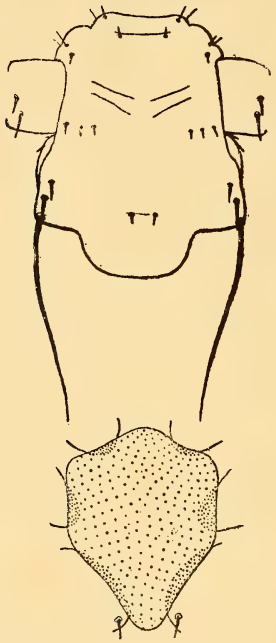

Fig. 1.—*Polyplax spinulosa* (Burm.); head of female and sternal plate of male from *Epimys norvegicus*.

fornicus (Inverness, Marin county, Freestone and Cazadero, Sonoma county, Gualala and Mendocino City, Mendocino county, Calif.), *Microtus* sp. (South Yolla Bolly Mt., Tehama county, Calif.), *Microtus mordax* (Tuolumne Meadows, Calif.), and *Phenacomys* sp., (Mendocino City, Calif.). We also have specimens from *Epimys rattus,* taken in India, and *Mus* sp. from Java. Osborn records it from the domestic rat at Ames, Iowa, and it has been recorded from various species of rats throughout Europe and Africa.

Comparison of the California specimens with those from India, together with reference to Fahrenholz's excellent paper upon this and other closely related species, enable us to be reasonably certain of our determinations. There are certain differences between the specimens from the various species of *Microtus* and *Phenacomys* and those from the rats, but these differences are on the whole so slight and so intangible, consisting merely of very small modifications of the shape and relative proportions of the head and sternal plate, that we do not feel justified in basing even a new variety upon them.

Polyplax auricularis n. sp.

Plate I, fig. 4; plate IV, fig. 8; text fig. 2.

One female, one male and two larvae from a single individual of *Peromyscus maniculatus rubidus,* (Inverness, Marin county, Calif.), and two females from *Peromyscus sitchensis prevostensis* (Forrester Island, Alaska, coll. Dr. Harold Heath), all referable to this curious species. It

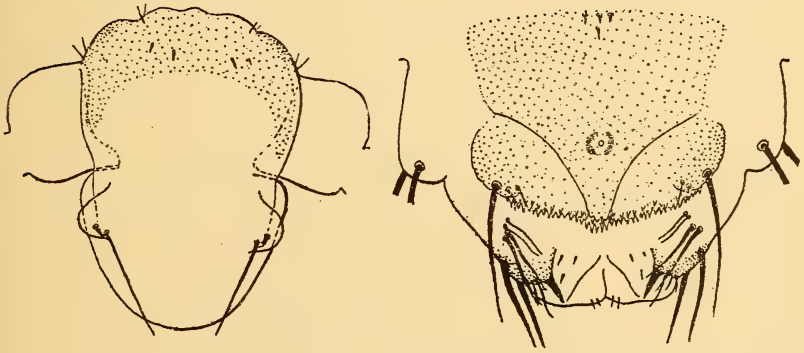

Fig. 2.—*Polyplax auricularis* n. sp.; head and ventral side of terminal segments of female.

is sharply distinguished from all the other species of *Polyplax* by the ear-like projections on the temporal margins of the head, by the large thorax and the enormously enlarged coxae of the posterior pair of legs. In the bi-partite character of the tergites and sternites of the abdomen and the presence of a projection on the third antennal joint of the male, it agrees very well with the other species of the genus.

Description of the Female.—Length 1.2 mm., length of head .22 mm., width of head .14 mm., width of thorax .25 mm., width of abdomen .4 mm.

Head but little longer than wide, having its greatest width across the temporal angles altho the width across the anterior margin is nearly as great. Anterior margin nearly straight, with a very slightly projecting median portion. Lateral margins of the forehead straight and nearly parallel, the temporal angles very inconspicuous. Temporal margins converging slightly in a smooth curve, meeting the slightly convex occipital margin without a perceptible angle. Just behind the antennae and slightly in from the temporal margin there rises on each side a small, rounded, ear-like flap which extends slightly beyond the margin and at the base of which there are a very short, stout spine and a slender hair close together. Across the forehead a broad, chitinized area which extends back nearly to the base of the antennae. Anterior margin with a few short hairs and a transverse row of four very small hairs just in front of the antennae. Antennae set very close to the anterior margin of the head, the first segment very broad, occupying nearly a third of the length of the head, and slightly broader than long. Second segment much more slender, but nearly as long as the first and attached close to the posterior margin of the latter. Third, fourth and fifth segments sub-equal, much shorter than the second.

Thorax very large, much wider than the head and about as long, with lateral margins rounding. Anterior margin with a shallow V-shaped notch, posterior margin deeply concave. Mesothorax with a pair of hairs on the posterior margin, just inside the spiracles. Metathorax nearly divided into two parts by the concavity in the posterior margin. First pair of legs small with slender claw; second pair larger, with heavier claw, slender femur and with the coxae projecting slightly beyond the lateral margin of the thorax; third pair very large, with long slender femur, and with the coxae enormously enlarged and projecting far beyond the margin of the thorax. Sternal plate large, irregularly hexagonal, with the anterior margin slightly convex and longer than the posterior margin, which is slightly concave. Abdomen elongated

oval, rather slender. First segment very narrow, with two short hairs. Second segment with two plates, each with four hairs. Third and eighth segments each with one plate and one row of six hairs. Fourth to seventh segments each with two plates and two rows of six hairs. Ninth segment with four hairs, the inner pair very short. Pleurites of the first segment apparently lacking, those of the second to seventh segments with a short tooth at each posterior angle and with two short spines on the posterior margin. Pleurites of the eighth segment not toothed and with the hairs longer than on the other segments.

On the ventral side the arrangement of the plates and hairs is practically as on the dorsum except that the first segment is apparently lacking and that the third segment has two plates. Genital plate pointed posteriorly and with a group of four short spines near the posterior margin. Gonapods with one long stout hair and two short ones. Behind the gonapods a group of four rather slender hairs, and at the posterior angles of the ninth segment a stout, inwardly projecting spine with three or four slender hairs and two stout hairs just outside it. Anterior lip of the vulva deeply fringed.

Description of the Male.—Length .92 mm., length of head .2 mm., length of abdomen .62 mm., width of head .14 mm., width of thorax .24 mm., width of abdomen .35 mm. Head, thorax and legs as in the female. Third antennal segment with the distal pre-axial angle prolonged into a pronounced projection. First segment of the abdomen with two hairs, second with two rows of hairs, the first of four, the second of eight. Third to seventh segments each with one row of six to eight hairs. On the ventral side the first, second and third segments each with two plates and two rows of hairs, remaining segments with one plate and one row of hairs. Posterior end of the abdomen pointed. Having but a single male we have been unable to work out the genitalia.

Genus **HOPLOPLEURA** Enderlein.

Hoplopleura Enderlein, Zool. Anz., vol. 28, pp. 221-223, (1904).
Haematopinus (Polyplax) Neumann, Archiv. de Parasit., vol. 13, p. 531, (1909).
Hoplopleura Mjöberg, Arkiv. för Zool., vol. 6, no. 13, p. 164, (1910).
Hoplopleura Fahrenholz, Reprint from the second, third and fourth Jahresb. des Niedersäch. Zool. Vereins zu Hannover, vol. 29, pp. 44-46, (1912).

Antennae five-segmented, similar in male and female. First pair of legs small with slender claws, second pair larger with broader claws,

third pair very large and stout with extremely broad, blunt claws and usually with a short, pointed process on the anterior margin of the tibia. Abdomen with well chitinized tergites and sternites, the fourth to seventh tergites and third to sixth sternites of the female being transversely divided into three distinct plates, the remaining tergites and sternites with either one or two plates, each plate with a transverse row of spines. The males in general have a smaller number of plates than the females, but the number is not constant thruout the genus. Anterior sclerite of the third sternite, in both male and female, with four or six very large and conspicuous spines. Pleural plates well developed, present on the first to eighth segments, large, usually overlapping and with the posterior margin variously toothed.

The genus is composed chiefly of Murid-infesting species, of the seven previously described species referable to it six being from Murids and one from a Sciurid. We are adding three new species from Sciurids, a new variety from Murids, and are recording one species, previously described, which also occurs upon Murids.

Hoplopleura acanthopus (Burm.) var. **americanus** n. var.

Plate IV, fig. 2; plate V, fig. 8; text fig. 3.

Haematopinus acanthopus Osborn, Bul. 7, o. c., U. S. Dept. Agr., Div. Ent., p. 23, (1891).

Numerous males and females from *Microtus constrictus* (Mendocino City, Mendocino county, Calif.); *Microtus californicus* (Covelo, Calif.); *Microtus* sp. (South Yolla Bolly Mt., Tehama county, Calif.), and three females and one male from "white lemming" (locality not known, possibly Pt. Barrow, Alaska). Osborn records it as *H. acanthopus,* from *Arvicola* sp. (Ames, Iowa), but an examination of his specimens has shown that they should be referred to this variety.

The variety is very close to the species, apparently differing from it only in the shape of the sternal plate, which has a more or less pronounced, rounded projection on the lateral margin which is absent in *H. acanthopus.* There is some variation but the character is usually plainly apparent, and it seems to be sufficiently constant to warrant the naming of a new variety.

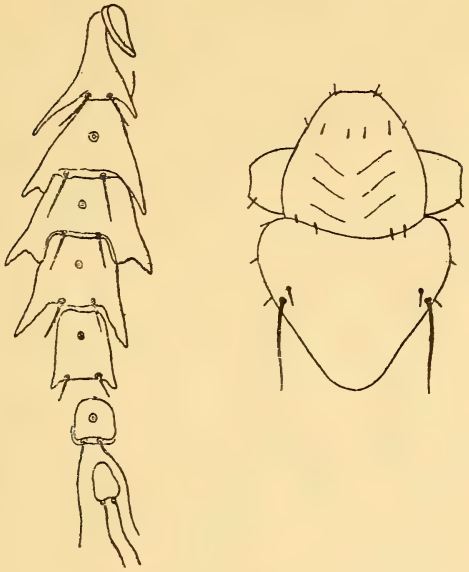

Fig. 3.—*Hoplopleura acanthopus* var. *americanus* n. var.; pleural plates and head of female.

Hoplopleura hesperomydis (Osborn).

Plate I, fig. 3; plate IV, fig. 1; plate V, fig. 14; text figs. 4 and 5.

Haematopinus hesperomydis Osborn, Bul. 7, o. s., U. S. Dept. Agr., Div. Ent., 26, fig. 14, (1891); Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., pp. 184-185, fig. 108, (1896).
Polyplax (?) hesperomydis Enderlein, Zool. Anz., vol. 28, p. 143, (1904).
Polyplax (?) hesperomydis Dalla Torre, Genera Insect., Anoplura, p. 13, (1908).

Numerous males and females from several individuals of *Peromyscus maniculatus rubidus* (Gualala, Mendocino county, Calif.); *Peromyscus maniculatus gambeli* (Covelo and South Yolla Bolly Mt., Tehama county, Calif.). Comparison of these specimens with Osborn's types shows them to belong unquestionably to this species. The specimens in the Osborn collection were taken from *Peromyscus leucopus* (Ames, Iowa).

H. hesperomydis seems to be closest to *H. acanthopus,* but differs from the latter in several well marked particulars. The sternal plate is smaller, more angular and more pointed posteriorly, the head is much more pointed posteriorly, and the pleural plates are quite different.

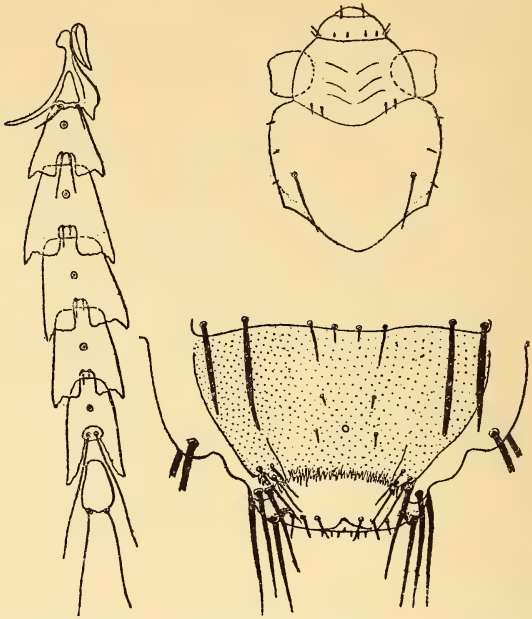

Fig. 4.—*Hoplopleura hesperomydis* (Osborn); pleural plates, head and ventral side of terminal abdominal segments of female.

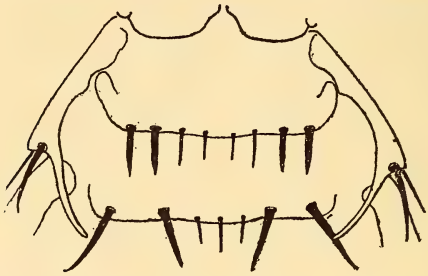

Fig. 5.—*Hoplopleura hesperomydis* (Osborn); ventral side of second and anterior portion of third abdominal segments.

Hoplopleura erratica (Osborn).

Haematopinus erraticus, Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., p. 186, (1896).
Polyplax (?) erratica Enderlein, Zool. Anz., vol. 28, p. 143, (1904).
Polyplax (?) erratica Dalla Torre, Genera Insect., Anoplura, p. 13, (1908).

We have not been able to see the type of this species, and the published description is a little too concise to permit of its certain identification. Professor Osborn, however, has sent us specimens of a species which he says is close to it, and, since these specimens which he has sent

us are of a species of *Hoplopleura,* we are assuming that *Haematopinus erraticus* is a species of *Hoplopleura,* and are therefore assigning it provisionally to this genus. Osborn records the species from a gull (beyond a doubt a case of straggling) and also from *Arvicola* sp. (= *Microtus* sp.), *Tamias striatus,* and *Sciuropterus volucella.* We have at hand specimens from hosts very closely related to these, and find that our material includes three species of the genus *Hoplopleura.* It being impossible to decide which, if any, of these species is *H. erratica* we are describing all of them as new in the hope that the matter may be cleared up later.

Hoplopleura arboricola n. sp.

Plate IV, fig. 4; plate VI, fig. 8; text figs. 6 and 7.

Numerous males and females from *Eutamias hindsi* (Inverness, Marin county, Calif.); *Eutamias townsendi ocrogenys* (Freestone and Cazadero, Sonoma county, Calif.); *Eutamias* sp. (Covelo, Calif.); *Eutamias* sp. (South Yolla Bolly Mt., Tehama county, Calif.; Sanhedrin

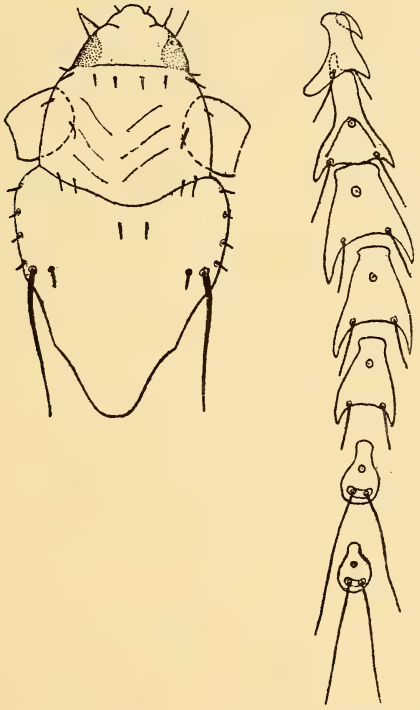

Fig. 6.—*Hoplopleura arboricola* n. sp.; head and pleural plates of female from *Eutamias townsendi ocrogenys.*

Mt., Calif.); *Sciurus griseus* (Inverness, Marin county; Freestone, Sonoma county, and Sanhedrin Mt., Calif.); *Sciurus douglasi mollipilosus* (Cazadero, Gualala, Mendocino county, South Yolla Bolly Mt., and Sanhedrin Mt.). Professor Osborn has sent us specimens from *Tamias striatus* (Ames, Iowa).

There is a considerable degree of variation among these specimens, yet they do not seem to represent more than one species. The species is apparently rather close to *H. maniculatus* (Neumann), the only species of *Hoplopleura* previously recorded from a Sciurid. It can be distinguished from the latter by the shape of the sternal plate.

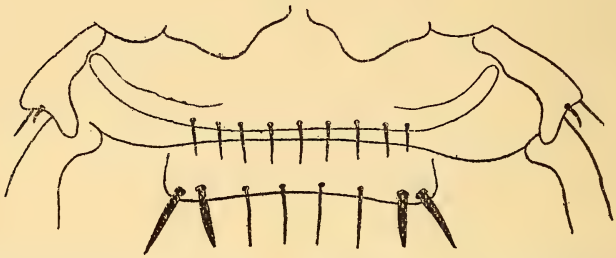

Fig. 7.—*Hoplopleura arboricola* n. sp; ventral side of second and anterior portion of third abdominal segments of female from *Eutamias townsendi ocrogenys*.

Description of the Female.—Length 1.00 mm., length of head .17 mm., length of abdomen .75 mm., width of head .12 mm., width of thorax .17 mm., width of abdomen .42 mm. Head narrow and rather pointed anteriorly, the temporal angles prominent, temporal margins nearly straight and slightly converging, forming a very slight angle with the occipital margin, which is produced into a rather sharp point. A small chitinized area bearing a single hair on each side, just in front of the antennae. Several small hairs on the anterior margin, a transverse row of six hairs in front, and a distinct suture just behind the antennae. Three or four small hairs along the temporal margin, and one long hair and a short spine at the posterior lateral angles. First antennal segment rather large; second slender; third, fourth and fifth shorter, the fourth with a slight post-axial projection.

Thorax relatively small, rather hexagonal in shape, wider than long, the V-shaped notch in the anterior margin very deep, the posterior margin of the prothorax with two long, widely-separated hairs. Sternal plate of the shape of an equilateral triangle with rounded angles and

convex sides. Legs of the type common to the genus, the projection on the tibiae of the third pair being extremely small or wanting.

Abdomen large and stout. First segment very narrow, with two spines; second with one row of four; third with two plates, the first with four spines, the second with eight or nine; all spines on these three segments being very small and slender. Fourth to seventh segments with three sclerites and three rows of fourteen to sixteen rather small and slender but distinctly awl-shaped spines. Eighth with one row of twelve similar spines, ninth with four very slender hairs.

Pleurites of the first segment very small and tooth-like; of the second with a short dorsal tooth, and two short spines on the posterior margin and a rather short knife-like process on the ventral side. Pleurites of the third to the sixth segments with a single long tooth at each posterior angle, the posterior margin being slightly concave and bearing two hairs. Pleurites of the seventh and eighth segments very small, each with two long hairs.

On the ventral side the first segment apparently lacking; the second with one sclerite and one row of eight short spines; the third to seventh with three sclerites, each with eight to ten spines, except the first sclerite of the third segment, which has the two pairs of large spines characteristic of the genus. In each of these pairs the spines are very close together and diverge but slightly. Last sclerite of the seventh segment with very short spines.

Genital plate with a number of small hairs, gonapods with three small hairs, a group of three or four moderately large hairs behind each gonapod, one very large hair and several small ones at each posterior angle of the ninth segment. Anterior lip of the vulva fringed.

Description of the Male.—Length .67 mm., length of head .16 mm., length of abdomen .47 mm., width of head .12 mm., width of thorax .17 mm., width of abdomen .32 mm. Head, thorax and legs resembling those of the female, the abdomen much smaller, slightly pointed posteriorly, and with fewer sclerites than in the females. Third tergite with two sclerites, remainder with one. Second sternite with one sclerite, third with three, fourth to sixth with two, seventh and eighth with one. The spines smaller and less numerous than in the female. Basal plate rather short and slender, parameres stout, more than half as long as the basal plate, penis with long slender point and diverging serrate arms.

Hoplopleura trispinosa n. sp.

Plate IV, fig. 3, text fig. 8.

Five specimens, all females, from *Sciuropterus volucella* (Kensington, Md.); *Sciuropterus* sp. (Eureka, Calif., and Brownsville, Oregon), taken from skins in the Stanford University collection.

This species is very close to *H. arboricola,* but is readily distinguished from the latter by the form of the sternal plate, which is more elongated, and by having six large spines on the first sclerite of the third sternite of the abdomen instead of four.

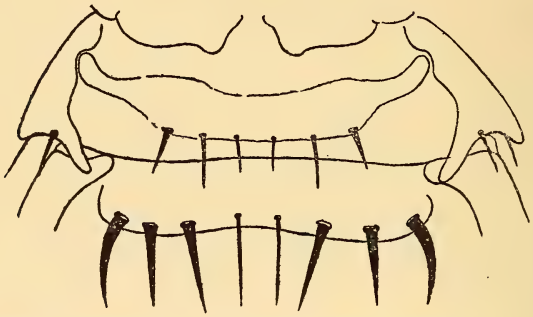

Fig. 8.—*Hoplopleura trispinosa* n. sp.; ventral side of second and anterior portion of third abdominal segments of female.

Description of the Female.—Length .72 mm., length of head .15 mm., length of abdomen .55 mm., width of head .1 mm., width of abdomen .4 mm., width of thorax .2 mm.

Head pointed anteriorly, temporal angles prominent, temporal margins nearly straight, forming a very slight angle with the occipital margin, which is produced into a point. A brown chitinized area on each side just in front of the antennae. Several small hairs on the anterior margin, three or four on the temporal margin, and one long hair and a short spine at the posterior lateral angle. A distinct transverse suture just behind the antennae. Antennae with the first segment large; second segment about as long as the first but much more slender; third, fourth and fifth segments shorter, subequal.

Thorax hexagonal in shape, wider than long, the posterior margin of the prothorax with a hair on each side just within the spiracle. Sternal plate triangular, lateral margins longer than the anterior margin. Legs

of the type usual in the genus, except that the projection on the anterior margin of the tibiae of the third pair is extremely small.

Abdomen elongated oval. First segment with one sclerite bearing two widely separated pairs of slender hairs, each sclerite of the third segment with seven hairs of the same type. Fourth to seventh segments each with three sclerites and ten to fourteen small, awl-shaped spines. Eighth segment with one sclerite and six spines. Ninth segment with two very small hairs.

Pleurites of the first segment small and tooth-like, those of the second segment with a short knife-like process at the ventral posterior angle, and a short tooth at the dorsal posterior angle, and two hairs on the posterior margin. Pleurites of the third to sixth segments with a slender, rather long tooth at each posterior angle, and two hairs on the posterior margin. Pleurites of the seventh and eighth segments small, not toothed and with two long hairs.

On the ventral side the first segment apparently lacking, the second with one row of six small spines. Third to seventh segments with three sclerites each, all except the first sclerite of the third segment bearing six to eight awl-shaped spines. The first sclerite of the third segment bears eight spines, of which the median pair are very small, and the remainder large and conspicuous, the outer spine on each side being bent inward.

Genital plate bluntly pointed posteriorly, with four small hairs near the tip. Gonapods with two small hairs and one large hair. Caudad of each gonapod a group of three or four stout hairs, a stout spine and several small hairs at the posterior angles of the ninth segment.

LINOGNATHOIDES Cummings.

Linognathoides Cummings, Bul. Ent. Res., vol. 5, pt. 2, pp. 159-160, (1914).

Resembling *Polyplax* except for the absence of definite, well chitinized tergal and sternal plates. Antennae of the male without a preaxial process on the third segment.

This genus is very close to *Polyplax,* yet it seems to form a well differentiated group. It was but recently established by Cummings for a single species, *L. spermophili,* taken from a species of *Spermophilus* and also from a Murid in Asia. In the paper in which the genus is defined Cummings suggests that an American species, *Polyplax (?) montanus* (Osborn) should be referred to this genus, and this surmise we find to be correct. In addition to this species, we are recording two new species, one from a Murid and one from a Geomyid.

It was suggested by Cummings that the presence of a pair of finger-like flaps at the end of the abdomen of the male may perhaps be characteristic of the genus. We find, however, that in one species these flaps are not present, and furthermore that they are present in the genus *Neohaematopinus*. In fact we are of the opinion that in general but little reliance should be placed upon the males in determining generic relationships, altho there certainly are some exceptions to this.

Linognathoides montanus (Osborn).

Plate V, fig. 1; plate VI, fig. 4; text fig. 9.

Haematopinus montanus Osborn, Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., p. 184, fig. 107, (1896).
Haematopinus columbianus Osborn, Can. Ent., vol. 32, p. 215, (1900).
Polyplax (?) montana Enderlein, Zool. Anz., vol. 28, p. 143, (1904).
Polyplax (?) columbiana, ibid.
Polyplax (?) montana Dalla Torre, Genera Insect., Anoplura, p. 13, (1908).
Polyplax (?) columbiana, ibid.
Linognathoides (?) columbianus Cummings, Bul. Ent. Res., vol. 5, pt. 2, p. 160, (1914).

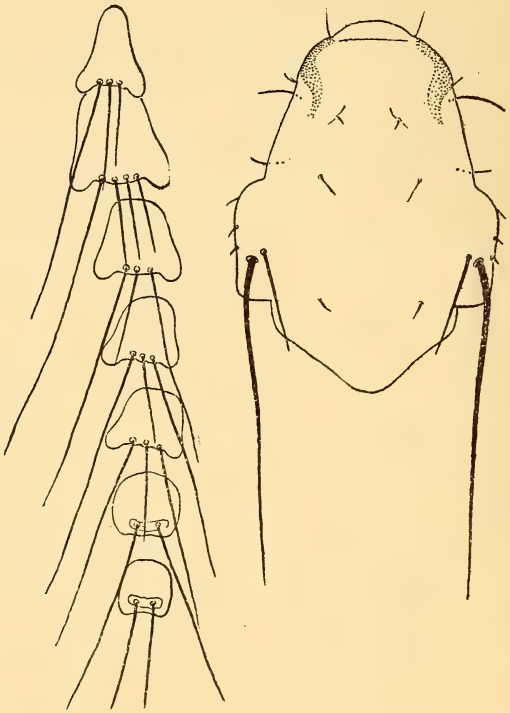

Fig. 9.—*Linognathoides montanus* (Osborn); pleural plates and head of female from *Citellus beacheyi douglasi.*

Numerous males, females and larvae from *Citellus beecheyi douglasi* (Cazadero and Palo Alto, Calif.), *Citellus beldingi* (Tuolumne Meadows, Calif.), *Citellus mexicanus* (Guanajuato, Mexico), *Citellus barrowensis* (Pt. Barrow, Alaska), "rock squirrel" (Boulder Canyon, Colo.), *Arctomys flaviventer* (Burns, Oregon), and *Citellus columbianus* (Pullman, Wash.); the last two records being of specimens taken from skins in the Stanford University collection. Osborn records the species from *Citellus columbianus* (Pullman, Wash.), and western gray squirrel (Fort Collins, Colo.).

An examination of Osborn's types of *Haematopinus montanus* and *H. columbianus,* together with the study of much other material which we have at hand, has convinced us that these two species really constitute but one species, which should be referred to the recently established genus *Linognathoides.* The name *montanus* having been first used, the species becomes *Linognathoides montanus* (Osborn).

There is a considerable degree of individual variation among our specimens, particularly as regards size and coloration, some specimens being much larger and more darkly colored than others; and there is also some variation in the shape of the sternal plate. However, to attempt to distinguish between these forms would require the naming of a variety for every host species.

Linognathoides inornatus n. sp.

Plate II, fig. 1; plate IV, fig. 7; plate V, fig. -5; plate VI, fig. 3; text fig. 10.

Two females and three males from three specimens of *Neotoma (Teonoma) cinerea occidentalis,* bushy-tailed wood-rat (South Yolla Bolly Mt., Tehama county, Calif.). This species differs from *L. columbianus* chiefly in the shape of the sternal plate and in the presence of a pair of finger-like processes at the end of the abdomen of the male.

Description of the Female.—Total length 1.3 mm., length of head .28 mm., length of abdomen .95 mm., width of head .18 mm., width of thorax .26 mm., width of abdomen .4 mm.

Head with the anterior margin slightly convex, the lateral margins of the forehead nearly parallel, diverging sharply immediately behind the antennae. Temporal margins nearly straight, converging slightly, the posterior lateral angles sharp. Occiput narrow, with the posterior margin prolonged into a point. A few small spines on the anterior margin,

and a narrow transverse chitinized band just within it. Temporal margin with three or four small spines; a long hair and a long stout spine at the posterior lateral angle.

Antennae close to the anterior margin of the head, the first segment large, the second more slender and about as long, the third, fourth and fifth shorter, subequal.

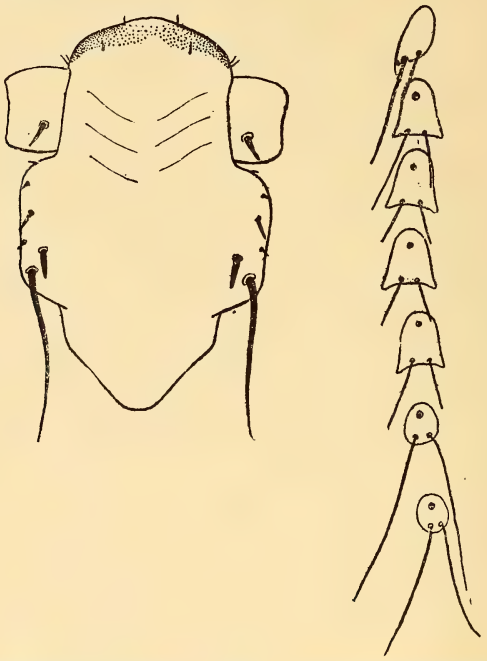

Fig. 10.—*Linognathoides inornatus* n. sp.; head and pleural plates of female.

Thorax wider than the head, widest across the middle, the lateral margins at first diverging sharply, then nearly parallel. Anterior margin with a deep V-shaped notch, the posterior margin nearly straight. Sternal plate kite-shaped, the posterior margin slightly concave. First pair of legs small, with slender, slightly bifid claw; the second and third pairs larger, and nearly equal to each other in size, the claw not extremely heavy.

Abdomen without tergal and sternal plates, the body-wall presenting a reticulated appearance. First segment narrow, with one transverse row of six hairs, the outer hair on each side being very short. Second segment with two rows of hairs, the first of five, the second of eight. Third to seventh segments with two rows of eight hairs. Eighth segment

with one row of four hairs. Third to seventh segments with two hairs near the lateral margin. All the hairs slender and bluntly pointed.

Pleurites of the first segment apparently lacking, of the second with a slight ventral tooth and two long hairs on the posterior margin. Pleurites of the third to sixth segments with a slight tooth at each posterior angle, and with two slender hairs on the posterior margin, the ventral hair being longer. Seventh and eighth pairs of pleurites small, without teeth, and with two long hairs.

On the ventral side the second to seventh segments each with two rows of six to eight hairs, the third to seventh segments with two hairs near the lateral margin. Genital plate with several small hairs; gonapods with one short hair and two long hairs, behind each gonapod a group of four or five stout hairs, and a group of several stout hairs at each posterior angle of the ninth segment. Vulva fringed.

Description of the Male.—Total length 1.1 mm., length of head .26 mm., length of abdomen .8 mm., width of head .16 mm., width of thorax .24 mm., width of abdomen .4 mm.

Head and thorax as in the female, except that the third antennal joint bears a pair of short, stout spines, which are not present in the female.

Abdomen with fewer rows of hairs on the dorsum, the second tergite only having two rows. Second to sixth sternite with two rows of hairs, the number and arrangement thruout being practically as in the female. Seventh sternite with but four hairs, of which the median pair are much the longest. Eighth sternite with two long spines. The ninth segment ending in a pair of finger-like processes. Basal plate rather long and slender, about twice as long as the parameres, which are rather stout. Penis long and slender, the arms diverging but little.

HAEMODIPSUS Enderlein.

Haemodipsus Enderlein, Zool. Anz., vol. 28, pp. 139-143, (1904).
Haematopinus (Polyplax) Neumann, Arch. de Parasit., vol. 13, p. 530, (1909).
Haemodipsus Dalla Torre, Genera Insect., Anoplura, p. 15, (1909).
Haemodipsus Mjöberg, Arkiv. för Zoologi, vol. 6, no. 13, p. 165, (1910).

Enderlein's definition of this genus is essentially as follows: Head short, swollen posteriorly, antennae standing far forward. Hind head without lateral projections. Abdomen without sclerites and plates, the outer wall quite smooth. Telson normal. Each of the seven sternites and eight tergites with a transverse row of rather closely spaced, very

long hairs near the posterior margin. Forcipes of the penis on each side with a large, heavily chitinized tooth. Spiracles very small. Anterior legs more slender and smaller than the others. Tibiae and tarsi as in *Linognathus.*

The genus was established for two species, *H. lyriocephalus* (Denny) and *H. ventricosus* (Denny), both occurring upon European species of hares and rabbits. Enderlein did not have specimens of *H. ventricosus,* and it has since been pointed out that in this species the pleural plates are really present, altho they are extremely small. Because of this it has been suggested that these two species should not be referred to the same genus. Mr. Cummings, of the British Museum, has very kindly sent us specimens of both species for examination, and we are of the opinion that they should be referred to the same genus, even though the pleural plates are really present in one and absent in the other. These plates are so extremely small in *H. ventricosus* that the step from "pleurites present" to "pleurites lacking" is after all not very great, especially as the two species agree very closely in other particulars. *H. lyriocephalus* may be distinguished from any of the species of *Linognathus,* in which genus the pleural plates are also lacking, by the extremely broad head and by the very short gonapods of the female.

There have previously been referred to this genus only the two species mentioned above. We are provisionally referring to it a third species, which we are describing as new, taken from a vizcacha *(Lagidium peruani)* in South America. This last species is certainly very different in many respects from the other two in the genus, yet there seems to be no good reason for establishing a new genus for it, and it cannot well be referred to any other genus as yet established.

Haemodipsus ventricosus (Denny).

Plate II, fig. 2; plate IV, fig. 5; plate V, fig. 12; text fig. 11.

Haematopinus ventricosus Denny, Mon. Anopl. Brit., p. 30, pl. 25, fig. 6, (1842).
Haemodipsus ventricosus Enderlein, Zool. Anz., vol. 28, p. 143, (1904).
Haematopinus ventricosus Osborn, Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., p. 182, (1896).
Haemodipsus ventricosus Dalla Torre, Genera Insect., Anoplura, p. 15, (1908).
Haematopinus (Polyplax) ventricosus Neumann, Arch. de Parasit., vol. 13, pp. 527-528, (1909).
Haemodipsus ventricosus Mjöberg, Arkiv. för Zoologi, vol. 6, no. 13, p. 165 (1910).

Four females from a hare, *Lepus californicus* (Freestone, Sonoma county, Calif.), and one very badly damaged female from a domestic rab-

bit (Panama Canal Zone). Osborn records it from a prairie hare, *Lepus campestris* (Ames, Iowa), and from an unnamed host (Baltimore, Md.). Through the kindness of Mr. Cummings we have been enabled to compare our specimens with a co-type of *H. ventricosus,* and are certain of our identification. The published descriptions of the species are rather unsatisfactory, and we are therefore re-describing it somewhat more fully.

Description of the Female.—Total length 1.5 mm., length of head .35 mm., length of abdomen 1.05 mm., width of thorax .28 mm., width of head .3 mm., width of abdomen .72 mm.

Fig. 11.—*Haemodipsus ventricosus* (Denny); pleural plate and ventral side of terminal abdominal segments of female.

Head with very convex anterior margin, widening slightly behind the antennae, the temporal margins convex and with an abrupt angle posteriorly; occiput rather narrow and quite convex. Anterior margin and forehead with several small hairs; a very faint transverse suture immediately behind the antennae with four small hairs arranged along it, four or five short spines along the temporal margin, and a single long hair at the posterior-lateral angle. Antennae set slightly in advance of the center of the head; first segment not conspicuously enlarged, about as wide as long; second segment of about the same length but more slender; third, fourth and fifth segments sub-equal.

Thorax relatively small, much narrower than the head and about twice as wide as long, widest posteriorly, apparently composed entirely of the prothorax. Anterior margin with a very deep and narrow V-shaped notch which reaches nearly to the posterior margin. A single short spine at each anterior angle, and a short spine and a long hair at each posterior

angle. First pair of legs small with slender claw, second and third pairs much larger than the first, nearly equal to each other, with broad claw. Sternal plate hexagonal, the anterior margin slightly the longest, the others nearly equal. All the pairs of coxae widely separated.

Abdomen large, elongated oval, without chitinized tergites and sternites, having everywhere a reticulated appearance, the divisions between the segments poorly defined. First segment very small and narrow, with one row of four hairs; second segment with two rows of hairs, the first of six, the second of eight; third to seventh segments each with one row of eight hairs; eighth with six, of which the median pair is longer than the others; ninth with none. Second to seventh segments each with a pair of hairs on each side close to the lateral margin.

Pleurites present on the third to sixth segments, very small, tooth-like, with the base attached to the body and the point free. Each with a single long hair on the posterior margin.

On the ventral side, segment one apparently with no hairs; segments two to five each with one row of six; six and seven each with one row of four. All except the first and ninth with two hairs near each lateral margin. Genital plate very poorly defined; gonapods small and bearing four or five small spines in a row on the posterior margin; just caudad of each gonapod a group of one large and several small hairs. Vulva fringed.

Haemodipsus parvus n. sp.

Plate II, fig. 4; plate IV, fig. 6; text fig. 12.

Five females from a vizcacha, *Lagidium peruani,* taken in Peru

Fig. 12.—*Haemodipsus parvus* n. sp.; pleural plates of female.

(C. H. T. Townsend). While the species is, in general appearance, very unlike the others in the genus to which we are referring it, there seem to be no good grounds for considering it as representing a new genus, and it certainly cannot be referred to any other than *Haemodipsus* among genera so far established. It differs from the other members of this genus in its small head, the shape and size of the pleurites, and the exceedingly small number of hairs on the abdomen.

Description of the Female.—Total length .7 mm., length of head .12 mm., length of abdomen .55 mm., width of head .1 mm., width of thorax .16 mm., width of abdomen .35 mm.

Head small and quite deeply inserted into the thorax, anterior margin somewhat convex, lateral margins nearly straight, the posterior margin slightly convex. Antennae set slightly in advance of the center of the head; the first segment not conspicuously enlarged; the second slightly more slender than the first and a trifle longer; the third, fourth and fifth subequal; the fourth with the outer posterior angle slightly produced. On each side immediately in front of the antennae there is a small brown patch. Several very small hairs on the anterior margin, a transverse row of four near the front of the head, another of four just in front of the antennae, and another of six somewhat farther back. A pair of spines about half way between antennae and the occipital margin and slightly in from the lateral margin, the inner being short, the outer longer, reaching slightly beyond the occiput.

Thorax considerably wider than the head, composed almost entirely of the pronotum, trapezoidal in shape, the lateral and posterior margins nearly straight, anterior margin with a shallow V-shaped groove which ends in a furrow that extends back to the posterior margin of the pronotum. A short spine in each anterior angle, the posterior margin of the pronotum bearing two short spines close together near the lateral margin, and a median pair of long hairs. First pair of legs small with slender claw; second and third pairs considerably larger, nearly equal in size, and with broad, stout claw. Sternal plate elliptical, the coxae widely separated.

Abdomen elongated oval in shape, about two-thirds as wide as long, with no chitinized tergal or sternal plates, the body-wall presenting a uniformly reticulated appearance, the divisions between the segments poorly defined. First to eighth segments with a median pair of hairs, close together; those of the eighth being very short, those of the others about as long as the segment. Second to seventh segments with one hair near the lateral margin. Eighth with two long hairs at the posterior

angle. Second to fifth segments with pleural plates which are nearly square and have the posterior angles produced into a short tooth. First with one very short hair, remainder without hairs.

On the ventral side, segment one with median group of two hairs; two to six with four; seven with two widely separated; all the segments except the first, eighth and ninth with a hair near the lateral margin. Genital plate with a transverse row of five or six small spines. Gonapods with two or three long hairs; ninth segment with two short, stout spines near the posterior margin.

FAHRENHOLZIA n. gen.

We are establishing this genus for a single species taken from a pocket rat, *Dipodomys californicus* (family Heteromyidae). The species is of interest not only as the type of a new genus, but as the first Anopluran to be recorded from any of this small and very peculiar family of rodents. The genus stands between *Haemodipsus* and *Enderleinellus,* having the middle and posterior pairs of legs of the same size, as in *Haemodipsus,* and having a projection on the anterior margin of the hind tarsi as in *Enderleinellus.* The second sternite bears a uair of chitinous plates of doubtful homology, which are perhaps the homologues of certain similar but much smaller plates on the third sternite in *Enderleinellus.* It is possible that these plates represent the pleurites of the first segment.

Diagnosis of the Genus.—Antennae five-jointed, similar in male and female. Eyes lacking. Anterior pair of legs small, with slender claws; middle and posterior pairs much larger, and with broad claws. Posterior tarsi with a short projection on the anterior margin. Abdomen without chitinized tergal and sternal plates. Pleural plates well defined, present on the second to fourth segments. Sternite of the second segment with a pair of chitinous plates, which may represent the pleurites of the first segment. Each segment with a single transverse row of spines. Named in honor of H. Fahrenholz, whose excellent papers upon the Anoplura have been of much assistance to us.

Fahrenholzia pinnata n. sp.

Plate III, fig. 2; plate V, figs. 5 and 6; plate VI, fig. 10; text fig. 13.

Numerous males and females from several individuals of *Dipodomys californicus* (pocket rat) all taken at Covelo, Calif.

Description of the Female.—Total length .92 mm., length of head .15 mm., length of abdomen .68 mm., width of head .13 mm., width of thorax .15 mm., width of abdomen .35 mm.

Head small, pointed anteriorly; temporal angles very small, the temporal margins slightly convex and nearly parallel, merging imperceptibly into the occipital margin, which is slightly pointed. All the hairs on the head are very small; the anterior margin with several transverse rows of four near the front of the head; another of four immediately in front of the antennae; one on each side close to the base of the antennae, and transverse row of six immediately behind the antennae; one on each temporal margin; and a diagonal row of three on each side, extending from slightly behind the antennae toward the occiput. A small brown patch on each side immediately in front of the antennae.

Fig. 13.—*Fahrenholzia pinnata* n. sp.; pleural plates and ventral side of terminal abdominal segments of female.

Antennae set slightly in advance of the center of the head, the first segment not conspicuously enlarged, and about as long as wide; the second segment nearly as wide as the first and slightly longer; the third, fourth and fifth segments subequal in length, and forming a very slight club. Ventral side of the head with a broad keel, which bears a short hair on each side, close to the base of the antennae. A few small hairs about the rostrum, which is close to the anterior margin.

Thorax small, entirely destitute of hairs, but little wider than the head, and only slightly wider than long; width across anterior and pos-

terior margins nearly equal; the anterior margin with a very deep V-shaped notch which reaches nearly to the posterior margin; lateral margins slightly convex, the posterior margin nearly straight. The division between the meso-thorax and meta-thorax is very indistinct, and the spiracles on the meso-thorax are extremely small.

First pair of legs small, with slender claw; second and third pairs about equal in size, each with a broad, heavy claw. The tarsus of the third pair bears on its outer anterior angle a short, sharp, thumb-like projection. Sternal plate roughly circular, about as wide as long, the anterior margin almost straight, the posterior margin slightly pointed. First and second pairs of coxae widely separated, third pair approximate or contiguous.

Abdomen elongated, with nearly parallel sides, the posterior margin rounded. There are no chitinized tergites or sternites, the derm having everywhere a reticulated appearance; the divisions between the segments are poorly defined, and each bears a single row of spines. First segment very small, with two small, quite widely separated hairs. The second and third segments are so fused as to be indistinguishable from each other, a median pair of small spines alone marking the posterior margin of the second. The two segments together form a trapezoid, widest behind and with nearly straight lateral margins. Third segment with six or seven spines, fourth with twelve, fifth to seventh with twelve to sixteen; all awl-shaped and about as long as the segment, except that on the seventh segment the third spine from the median line on each side is much longer than the others, reaching beyond the end of the body. Eighth and ninth segments each with two spines, those on the ninth being widely separated and quite short. Eighth with two long hairs on posterior angles.

There are four pairs of pleurites belonging to the second to fifth segments. The pleurites of the second segment are long and slender, expanded, and with two short lobes at the posterior end, buried in the ventral wall of the fused second and third segments, and entirely invisible from above. The pleurites of the third segment consist of a knife-like piece, with a single point, closely applied to the dorsum of the second and third segments, directly dorsad of the pleurites of the second segment, and bearing on the posterior margin one short and one very long hair. On the lateral body-wall between the pleurites of the second and third segments there is a row of three small hairs. The pleurites of the fourth segment are triangular in shape, with the posterior margin deeply concave and bearing one long and one short hair. The ventral half is attached to the ventral body-wall; the dorsal half is free and projects

from the body like a fin. Pleurites of the fifth segment small and tooth-like, with but one point, which also projects from the body laterally and bears two very small hairs on the posterior margin. The spiracles are all extremely small.

On the ventral side segment two with a median pair of spines, segments three to seven with fourteen to sixteen spines. Genital plate small, sharply pointed posteriorly. Gonapods with three very small hairs. Caudad of each gonapod a group of two small and two large hairs, and at the posterior angles of the ninth segment a group of three stout hairs. Anterior lip of the vulva fringed.

Resembling the female except for the smaller size, more pointed ab- .15 mm., length of abdomen .55 mm., width of head .12 mm., width of thorax .15 mm., width of abdomen .35 mm.

Resembling the female except for the smaller size, more pointed abdomen, and the absence of the pair of long hairs on the posterior margin of the seventh segment. Basal plate entirely divided, the two parts slender and widely separated, parameres likewise slender, strongly outwardly convex, and with knobbed tips. Penis small, apparently divided into two pieces.

NEOHAEMATOPINUS Mjöberg.

Neohaematopinus Mjöberg, Arkiv. för Zoologi, vol. 6, no. 13, p. 160.
Acanthopinus, ibid., pp. 160-161.
Neohaematopinus Cummings, Bul. Ent. Res., vol. 3, p. 393, (1912).

Antennae five-segmented, set very close to the anterior margin of the head. Basal segment with the distal post-axial angle more or less produced, and bearing a stout spine; or with this angle not produced, but with a stout spine on the posterior margin of this segment. In the former case the antennae of both female and male are similar in shape, in the latter case the distal pre-axial angle of the third segment in the male is more or less produced. Head extremely broad, narrower than the thorax. Anterior pair of legs small, with slender claw; middle and posterior pairs subequal, larger than the first pair, and with stout claws.

Abdomen with or without distinctly chitinized tergal and sternal plates, usually with the second to seventh tergites and second to sixth sternites with two rows of spines, the remainder with one. Pleural plates present on the first to seventh segments. Posterior margin of the second tergite in the male slightly emarginate, and with a closely set group of spines of various lengths at each end of the emargination.

This genus was established by Mjöberg for a single species, *N. sci-*

uropteri (Osborn), and immediately following his diagnosis of it he proposed a second genus, *Acanthopinus,* which Cummings has quite recently shown should be united with *Neohaematopinus.* We have specimens of both genera and are entirely in accordance with the opinion of Cummings, for, altho there appears at first sight to be a division into two sharply marked groups, these groups are connected by intermediate forms.

The genus is extremely close to *Polyplax,* yet there are certain characters common to all its members which are found in none of the species of *Polyplax.* Of these differences the most notable is the character of the second tergite of the male, which in all the species of *Neohaematopinus* thus far described has the posterior margin distinctly emarginate and bearing a closely set group of spines of various lengths at the ends of this emargination—a character that is present in none of the males of *Polyplax.*

The genus is composed entirely of Sciurid-infesting species, at present five in number. We are recording two species previously described, and one which is new.

Neohaematopinus sciuropteri (Osborn).

Plate I, fig. 1; plate V, figs. 2 and 13.

Haematopinus sciuropteri Osborn, Bul. 7, o. s., U. S. Dept. Agr., Div. Ent., pp. 23-24, fig. 12, (1891); Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., pp. 182-183, fig. 105, (1896).

Neohaematopinus sciuropteri Mjöberg, Arkiv. för Zoologi, vol. 6, no. 17, p. 160, (1910).

One male, taken from a skin of *Sciuropterus* sp. (Eureka, Calif.) in the Stanford University collection. The species was originally described from the male alone, and no description of the female has ever been published.

Neohaematopinus antennatus (Osborn).

Plate V, fig. 10; plate VI, fig. 5; text fig. 14, *A* and *B*.

Haematopinus antennatus Osborn, Bul. 7, o. s., U. S. Dept. Agr., Div. Ent., p. 25, fig. 13, (1891); Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., pp. 183-184, fig. 106, (1896).

Polyplax (?) antennata Enderlein, Zool. Anz., vol. 28, p. 143, (1904).

Polyplax (?) antennata Dalla Torre, Genera Insect., Anoplura, p. 13, (1908).

Acanthopinus antennatus Mjöberg, Arkiv. för Zoologi, vol. 6, no. 13, p. 161, (1910).

Several males and females from *Sciurus griseus* (Inverness, Marin

county; Freestone, Sonoma county; Sanhedrin Mt., Mendocino county, Calif.), and *Sciurus douglasi mollipilosus* (Cazadero and Freestone, Sonoma county; Gualala, Mendocino county, Calif.). One female from *Sciurus fossor nigripes* (Mt. Hamilton, Calif.).

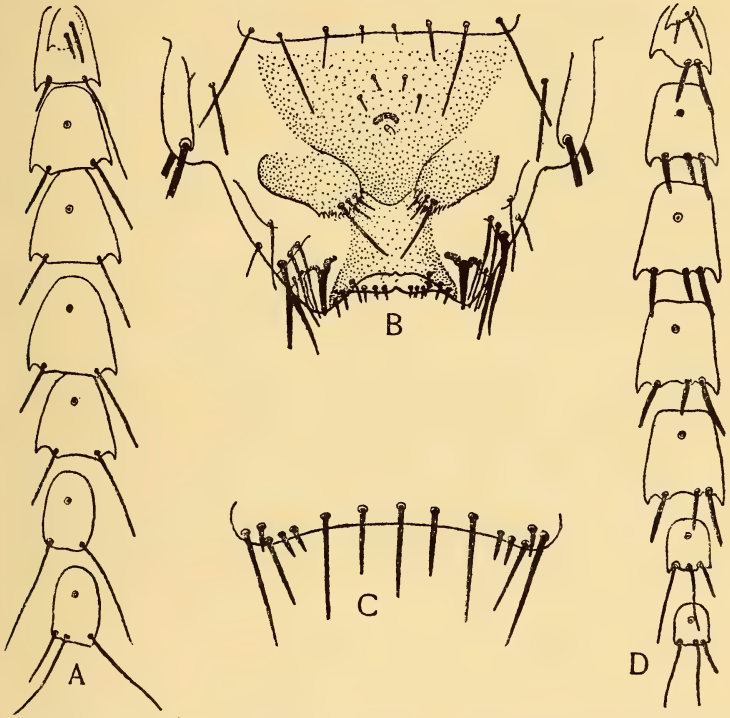

Fig. 14.—*Neohaematopinus antennatus* (Osborn); A, pleural plates, and B, ventral side of terminal abdominal segments of female from *Sciurus griseus*. *Neohaematopinus pacificus* n. sp.; C, posterior margin of third abdominal tergite male, and E, pleural plates of female..

We are referring these specimens to *N. antennatus,* altho we have not seen the type of this species and cannot be absolutely sure of our determination. Professor Osborn has sent us specimens of a species labelled "near *antennatus*" which differ from our specimens in having the distal, post-axial angle of the first antennal segment much less produced, but agree with our specimens in other particulars. Osborn records the species from *Sciurus cinereus* var. *ludovicianus* (Ames, Iowa). Our specimens are characterized by the almost entire absence of chitinized tergal and sternal plates, altho in some specimens these are present as narrow bands immediately in front of the transverse rows of hairs.

Neohaematopinus pacificus n. sp.

Plate I, fig. 2; plate V, figs. 3, 7*a* and 7*b*; text fig. 14, *C* and *D*.

Numerous males and females from *Eutamias townsendi ocrogenys* (Freestone, Sonoma county, Calif., and Gualala, Mendocino county, Calif.), *Eutamias hindsi* (Cazadero, Sonoma county, Calif.), *Eutamias* sp. (South Yolla Bolly Mt., Tehama county, Calif.), and *Eutamias* sp. (Sanhedrin Mt., Mendocino county, Calif.). Two females and one male from a skunk, *Mephitis occidentalis* (Covelo, Mendocino county, Calif.), this last record evidently being due to straggling from chipmunk prey of the skunk.

This species differs from *N. antennatus* (Osb.) in having the anterior division of each segment of the abdomen distinctly chitinized. It is evidently quite close to *N. sciurinus* (Mjöberg), a European species, but seems to differ from it in the shape of the head.

Description of the Female.—Total length 1.00 mm., length of head .2 mm., length of abdomen .7 mm., width of head .17 mm., width of thorax .2 mm., width of abdomen .45 mm.

Head with the anterior margin very slightly convex and with a slight median point. Lateral margins of the forehead nearly straight and converging somewhat. Temporal angles very prominent, the temporal margins slightly emarginate, the posterior-lateral angles sharp and prominent. Occiput narrow and with posterior margin produced into a slight point. A small brown patch on the anterior margin on each side of the median line. Temporal margin with three or four short spines, a long pair and a short stout spine at the posterior-lateral angle. Antennae very close to the anterior margin. First segment large, the distal post-axial angle slightly produced and bearing a short, stout spine. Second segment more slender but almost as long, with nearly parallel sides. Third segment very short, widest distally, the anterior margin longer than the posterior. Fourth segment similar, but with the posterior margin longer than the anterior. Fifth joint small.

Thorax shorter and wider than the head, with convex lateral margins, widest slightly anterior to the posterior margin, which is nearly straight. A short spine on each shoulder and two widely separated pairs of spines on the posterior margin of the meso-thorax, the outer spine of each pair being short and sharp, the inner one long and hair-like. Sternal plate kite-shaped, with the posterior margin slightly concave.

First pair of legs rather small, with slender claw; second and third pairs large, subequal, with rather heavy claws.

Abdomen elongated oval. First segment narrow, with eight spines of varying lengths on the posterior margin. Second to seventh segments with two transverse rows of eight to twelve rather slender spines, and with two spines near each lateral margin. Eighth and ninth segments with one row of six spines. The first tergite, both divisions of the second, and the anterior division of the third to seventh tergites, show a well defined chitinized plate. The remaining divisions are not chitinized. First pair of pleurites extremely small, with two short spines, and closely oppressed to the second pair. Second to sixth pairs with a slight tooth at each posterior angle, second with two stout spines close together on the posterior margin, the third to sixth with three similar spines. Seventh and eighth pairs smaller, without teeth, and with three slender hair-like spines.

On the ventral side, the first segment lacking, the second to sixth segments with the same arrangement of plates and spines as is shown on the dorsum. Seventh segment with one sclerite and eight spines, the outer pair on each side very long, the remainder very small. Genital plate with four small spines arranged in a semicircle near the center; gonapods with three long and slender hairs, caudad of each gonapod a cluster of spine-like hairs, each tuft composed of two stout hairs and several small ones directly behind the gonapod. Three or four stout hairs and several small ones at each posterior angle of the ninth segment.

Description of the Male.—Total length .9 mm., length of head .2 mm., length of abdomen .6 mm., width of head .17 mm., width of thorax .2 mm., width of abdomen .4 mm.

Head, thorax and legs as in the female. Third joint of antennae with two short, stout spines near the tip, which are not present in the female.

Abdomen with a smaller number of rows of hairs than in the female, the second tergite and the second to sixth sternites only having two rows, the remainder one. Tergites with well defined chitinous plates, sternites with the anterior portion only chitinized. Second plate of the second tergite slightly emarginate, with a group of two long and two very short spines at the posterior angles, and with five spines between these groups. Eighth tergite without spines, seventh sternite with six, eighth sternite with two, remaining rows with practically the same number as in the female.

Abdomen pointed posteriorly, ending in a pair of finger-like pro-

cesses. Basal plate long and slender. Parameres long and stout. Penis long and slender, with arms diverging but slightly.

Genus **ENDERLEINELLUS** Fahrenholz.

Enderleinellus Fahrenholz, Zool. Anzeiger, vol. 39, p. 56, (1912).
Enderleinellus Fahrenholz, Reprint from second, third and fourth Jahresbericht des Niedersächsischen Zool. Vereins zu Hannover (Zoologische Abteilung der Naturhistorischen Gesellschaft zu Hannover), pp. 52, 58, (1912).

Antennae five-segmented. Anterior and middle pairs of legs of the same size, small, with slender pointed claws, posterior pair much larger and heavier with very stout claws, the tarsi with or without a sharp process at the outer, anterior angle.

Abdomen without chitinized tergal and sternal plates or with these plates but weakly developed. Second tergite and third sternite with two transverse rows of hairs, remaining tergites and sternites with one row. Pleural plates present on second to fifth or sixth segments. Third sternite with a pair of widely separated chitinous plates of doubtful homology.

This genus was established for a single species, *E. sphaerocephalus* (Burm.), found upon squirrels in Europe. We are referring to it one species, *E. suturalis* (Osborn), which has previously been referred to *Polyplax,* a new variety of this species, and two new species, all being from Sciurids.

Enderleinellus suturalis (Osborn).

Plate IV, fig. 9.

Haematopinus suturalis Osborn, Bul. 7, o. s., U. S. Dept. Agr., Div. Ent., p. 27, fig. 15, (1891); Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., p. 185, fig. 109, (1896).
Polyplax (?) suturalis Enderlein, Zool. Anz., vol. 28, p. 143, (1904).
Polyplax (?) suturalis Dalla Torre, Genera Insect., Anoplura, p. 14, (1908).

Through the kindness of Professor Osborn we have been enabled to examine specimens of this species taken from *Citellus franklini* (Ames, Iowa). Since we are describing a variety of this species and also a new species very closely related to it, we are redescribing it more fully here. We may remark that *Polyplax otomydis* Cummings, which was stated by its author to be very close to *E. suturalis,* is, as a matter of fact, very different, the only point in which the two species at all closely resemble each other being in the common possession of the transverse suture across the head.

Description of the Female.—Total length .85 mm, length of head .25 mm., length of abdomen .45 mm., width of head .14 mm., width of thorax .20 mm., width of abdomen .45 mm.

Head much longer than wide, rather cylindrical in shape and with the antennae set well forward. The anterior margin is roundly pointed, there are no temporal angles and the temporal margins are for the greater part of their length parallel and nearly straight, finally converging in a smooth curve to form the slightly rounded occiput. Just behind the antennae is a conspicuous, transverse suture. The anterior margin bears several short hairs, there are two short hairs on each side in the anterior angle between the lateral margin and the suture, and a single short hair on each side just behind the suture. The rostrum is set close to the anterior margin and is surrounded by a chitinous ring.

Antennae set well back from the anterior margin of the head; first segment not conspicuously enlarged, second segment longer but nearly as wide at its outer end. The third, fourth and fifth segments are subequal in length, but the fourth segment is wider than the other two, giving the antennae a slightly clavate appearance.

Thorax very short, widest about the middle, the anterior margin with a V-shaped notch, the posterior angle nearly straight and wider than the anterior, the lateral margins convex. Mesothorax with a pair of large spiracles and a medium pair of rather long hairs on the posterior margin. First and second pairs of legs long and slender, with slender claws which are slightly bifid at their tips. Third pair very large, with broad, heavy claws and with a blunt, tooth-like projection on the anterior margin of the femora. Sternal plate slightly longer than wide, the lateral margin nearly straight diverging very slightly, the posterior margin nearly straight, the anterior margin quite convex. Coxae of first and second pairs of legs widely separated, of the third pair approximate or contiguous.

Abdomen almost circular in outline without chitinized dorsal and ventral plates. A single row of spines on each segment except the first, which has none. Second segment with a median pair of rather short hairs and a single hair near each lateral margin. Second to seventh segments each with eighteen to twenty-four long, slender, bluntly-pointed hairs, arranged in three groups, a median group of eleven to fourteen and two lateral groups of six to eight, the groups, however, not very distinctly separated. Eighth and ninth segments with a median pair of hairs; seventh and eighth segments each with two long hairs at the posterior angles. Only the second to fourth segments bear pleurites. All

are triangular in shape with the posterior margin longest and somewhat concave, the posterior angles produced into broad, rounded points. The first bears no hairs, the second, which is the largest, bears a moderately long, stout, blunt hair and a very short one, and the third and fourth each bear two long hairs, in each case that on the dorsal side being the longer. The second segment bears on the ventral side, slightly in from the pleurite, a small chitinized piece, of doubtful homology, but perhaps representing the remnant of the first pleurite.

On the ventral side of the abdomen all the spines are appreciably shorter and stouter than on the dorsal side, and the number is somewhat smaller. The genital plate is very broad, slightly pointed posteriorly and very convex anteriorly, apparently including a portion of the seventh segment since the row of hairs on this segment extends partly across the genital plate. The gonapods each bear two very short hairs. Behind each gonapod a group of two long stout hairs and two more slender hairs. A short, sharp, stout spine inwardly pointing on the ninth segment. Vulva not fringed.

Description of the Male.—Length .75 mm., length of head .22 mm., length of abdomen .45 mm., width of head .12 mm., width of thorax .2 mm., width of abdomen .4 mm.

In general closely resembling the female except for its slightly smaller size and more pointed abdomen. The number of spines on the abdomen is slightly less than in the female, there being four to six less hairs in each row.

Basal plate rather short, divided into two slender rods, which are united only at their anterior ends. Parameres shorter than the basal plate, slender, curved inward at the posterior end; penis very small and inconspicuous.

Enderleinellus suturalis var. **occidentalis** n. var.

Plate II, fig. 3; plate IV, fig. 10; plate V, fig. 17.

Several males and females from two individuals of *Callospermophilus chrysodeirus trinitatus* (South Yolla Bolly Mt., Tehama county, Calif.). The variety differs from *E. suturalis* in the conspicuously smaller number of spines on the abdomen and in the shape of the sternal plate. The number of spines on each abdominal segment is from fourteen to eighteen, as compared with eighteen to twenty-four in *E. suturalis,* and the division into three groups is much more marked. The sternal plate is shorter and more nearly round than in *E. suturalis.*

Enderleinellus osborni n. sp.

Plate IV, fig. 11; plate VI, fig. 6; text fig. 15.

Numerous males and females from several individuals of *Citellus beecheyi douglasi* (ground squirrel) (Cazadero and Covelo, Calif.). The species is close to *E. suturalis,* differing chiefly in the shape of the sternal plate and the size and number of the abdominal spines, which are much fewer and much shorter and stouter.

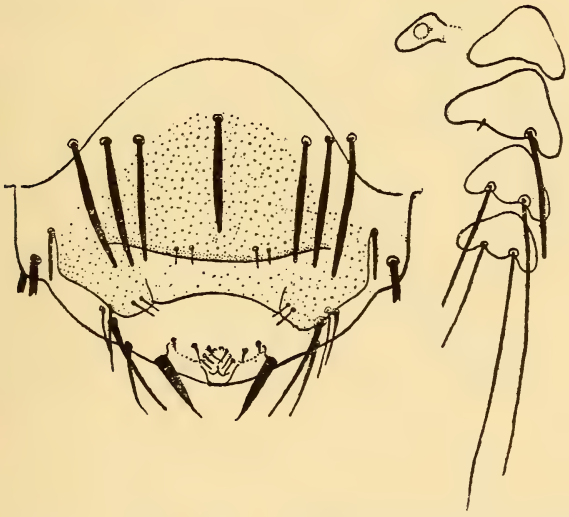

Fig. 15.—*Enderleinellus osborni* n. sp.; ventral side of terminal abdominal segments, and pleural plates of female.

Description of the Female.—Total length .6 mm., length of head .18 mm., length of abdomen .35 mm., width of head .1 mm., width of thorax .16 mm., width of abdomen .33 mm.

In size and general appearance closely resembling *E. suturalis.* Head, thorax and legs not appreciably different. The sternal plate, however, is longer than wide, four-sided, the lateral margins the longest, and the posterior margin longer than the anterior. Anterior and posterior margins slightly convex, lateral margins concave, all the angles rounded.

First segment of the abdomen with no hairs, second with a median group of one or two and with two near each lateral margin, all being quite short and slender. Third segment with a median group of two or three small spines and lateral group of two long flat spines. Fourth with

a median group of four, of which the two inner ones are short and flat, and the two outer ones are extremely long and slender, reaching beyond the end of the body, and with two or three very large flat spines in each lateral group. Segments five to seven each with four spines in each median group and two or three in each lateral group. Eight and nine each with median group of two, those of nine being small; and seven and eight each with two long hairs at the posterior angle. There is considerable variability in the number and arrangement of the spines, particularly as regards the long hairs on the fourth segment. In some cases there may be three or even four of these, or some of the spines on the third segment may also be elongated.

On the ventral side the spines are much shorter and broader than on the dorsal side; segment two with none; segment three with a group of three on each side; four, five and six with three or four in the median group and two or three in each lateral group; seven with one median spine. Genital plate and gonapods very similar to those of *E. suturalis*.

Measurements of the Male.—Total length .61 mm., length of head .18 mm., length of abdomen .35 mm., width of head .1 mm., width of thorax .16 mm., width of abdomen .33 mm. Resembling the female except that the long hairs on the fourth segment are lacking. Genitalia not differing appreciably from those of *E. suturalis*.

Enderleinellus longiceps n. sp.

Plate II, fig. 5; plate IV, fig. 12; plate VI, fig. 2.

In the material which we have received from Professor Osborn there are several specimens of an undescribed Anopluran taken from gray squirrels at Lincoln, Nebraska, and with the permission of Professor Osborn we are describing the species. It is closely related to *Enderleinellus sphaerocephalus* (Burm.), which occurs upon squirrels in Europe; but there are certain very marked differences between the two, the shape of the head and especially the character of the male genitalia distinguishing the American species at once.

Description of the Female.—Total length .51 mm., length of head .14 mm., length of abdomen .33 mm., width of head .8 mm., width of thorax .14 mm., width of abdomen .25 mm.

Head much longer than broad, rather cylindrical in appearance, widest across the base of the antennae. Anterior margin slightly convex, lateral margins parallel, nearly straight, temporal angles entirely lacking. A few small hairs on the margin, a transverse row of four, ar-

ranged in two pairs just behind the antennae, a third row of four larger hairs just in front of the anterior margin of the thorax, and three small hairs on each temporal margin.

Antennae very close to the anterior margin of the head, the first segment almost entirely concealed beneath the head, and not conspicuously enlarged. Second segment slenderer, about as long as the first; third, fouth and fifth segments subequal, shorter than the second. Rostrum near the anterior margin.

Thorax wider than the head and longer than wide, rather hexagonal in shape, the lateral margins sharply convex. A short spine at each shoulder and a median pair of hairs on the posterior margin of the prothorax. Sternal plate spade-shaped, with a short handle-like projection anteriorly.

First and second pairs of legs rather small and slender, with slender claws. Third pair much larger and heavier, with very heavy claws, and with a small tooth-like projection on the anterior margin of both the femur and tarsus.

Abdomen short, oval, widening rather abruptly behind the second segment; which is only slightly wider than the thorax. No chitinized tergal or sternal plates, the derm having a uniformly reticulated appearance. The hairs on each segment are arranged in three groups, a median group and a group near each lateral margin, the groups being distinctly separated. The arrangement of the spines in the lateral groups as follows: first segment, none; second segment, one in each group; third segment with two; fourth, fifth and sixth segments with three; eighth with one. Hairs in the median groups as follows: first, second and third segments with four; fourth, fifth and sixth with six; eighth with four; ninth with two. Seventh segment with the groups merging and forming an unbroken row of eight spines, and with two long hairs at each angle. Eighth likewise with two long hairs at each angle. Pleurites present on the second to fifth segments, small and with a short, rounded tooth at each posterior angle, and two or tree short spines on the posterior margin.

On the ventral side the first segment apparently lacking; second with one row of three or four spines; third with two rows, consisting of a median group of six and two lateral groups of two each. Fourth to sixth segments as on the dorsum. Seventh with four spines in the median group and one in each lateral group. Genital plate very large. Gonapods with several short hairs, a large, stout spine, and several hairs at each angle of the ninth segment. Third sternite with a pair of small chitinous plates, the posterior end of each slightly notched, and with a short spine in the notch.

Description of the Male.—Total length .51 mm., length of head .14 mm., length of abdomen .32 mm., width of head .8 mm., width of thorax .15 mm., width of abdomen .25 mm.

Similar to female except in having the body more slender, and in the presence of a narrow, transverse, chitinized strip in front of each row of spines on the abdomen. Posterior end of the abdomen rounded. Genitalia very large and conspicuous and of a very peculiar form. Basal plate divided into two slender, widely-separated rods; parameres apparently lacking, although the homology of the parts is extremely obscure.

HAEMATOPINOIDES Osborn.

Haematopinoides Osborn, Bul. 7, o. s., U. S. Dept. Agr., Div. Ent., p. 28, (1891); Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., p. 187, (1896).
Haematopinoides Enderlein, Zool. Anz., vol. 28, p. 140, (1904).
Haematopinoides Dalla Torre, Genera Insect., Anoplura, p. 15, (1908).

Antennae three-segmented. Middle and anterior legs small, posterior pair larger. Abdomen without chitinized tergal and sternal plates, but with the pleural plates present on the first to eighth segments, very large and overlapping.

Haematopinoides squamosus Osborn.

Haematopinoides squamosus Osborn, Bul. 7, o. s., U. S. Dept. Agr., Div. Ent., p. 28, fig. 16, (1891); Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., p. 187, fig. 110, (1896).
Haematopinoides squamosus Enderlein, Zool. Anz., vol. 28, p. 136, (1904).
Haematopinoides squamosus Dalla Torre, Genera Insect., Anoplura, p. 15, fig. 10, (1908).

This singular species has been recorded but once, having been taken from a pocket gopher, *Geomys bursarius* (Ames, Iowa). We are inclined to believe that its natural host is not one of the *Geomyidae,* since the examination of many specimens of several species of Geomyids in California has not revealed it. Furthermore a very similar species, if not indeed the same, has been recorded from a mole. We have not been able to see the type of the species.

EUHAEMATOPINUS Osborn.

Euhaematopinus Osborn, Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., p. 186, (1896).
Euhaematopinus Enderlein, Zool. Anz., vol. 28, p. 140, (1904).
Euhaematopinus Dalla Torre, Genera Insect., Anoplura, p. 16, (1908).

Antennae three-segmented. Thorax with a pair of large spiracles.

Anterior and middle pairs of legs of nearly the same size. Posterior pair much larger and heavier, with broad heavy claw and with a stalked disk-shaped appendage on the femur and tibia. No tergal and sternal plates. Pleural plates present on first to eighth segments.

Euhaematopinus abnormis Osborn.

Plate III, fig. 3; plate V, figs. 4 and 9; text fig. 16.

Euhaematopinus abnormis Osborn, Bul. 5, n. s., U. S. Dept. Agr., Div. Ent., p. 187, (1896).
Euhaematopinus abnormis Enderlein, Zool. Anz., vol. 28, p. 140, (1904).
Euhaematopinus abnormis Dalla Torre, Genera Insect., Anoplura, p. 16, (1908).

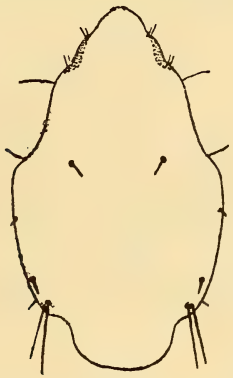

Fig. 16.—*Euhaematopinus abnormis* Osborn; head of female.

Through the kindness of Professor Osborn we have been permitted to examine the type of this species. It is extremely close to *Haematopinoides squamosus* Osborn, the only point of difference being the character of the posterior legs. These in *Euhaematopinus* are very short and heavy and bear a stalked disk-shaped appendage on the femur and tibia, while in *Haematopinoides* they are said to be normal. In all other respects—shape of the head, sternal plate and pleural plates, character of the antennae and absence of sternal and tergal plates—the species agrees entirely with Osborn's description and figure of *H. squamosus.* In fact we are strongly inclined to suspect that the two species are identical. The question can only be cleared up by the finding of the types of *H. squamosus,* unfortunately lost, or the re-discovery of the species. *Euhaematopinus abnormis* has been taken but once, from a mole, *Scalops argentatus* = *Scalopus aquaticus* (Ames, Iowa). We have examined several freshly-caught moles as well as several skins in the Stanford collection

without finding it. We did, however, find eggs, apparently of an Anopluran, upon one skin.

Family ECHINOPHTHIRIIDAE Enderlein.

Echinophthiriidae Enderlein, Zool. Anz., vol. 28, p. 137, (1904).
Echinophthiriidae Enderlein, ibid., vol. 29, p. 661, (1905).
Echinophthiriidae Enderlein, Deutsche Südpolar Expedition, vol. 10, part. 4, pp. 476, 505, 506, (1909).
Echinophthiriidae Mjöberg, Arkiv. för Zoologi, vol. 6, no. 13, p. 176, (1912).
Lepidophthiriidae (in part) Mjöberg, ibid., p. 177.

Body thick and plump, thickly beset with spines or with scales. Head not prolonged cylindrically, widened posteriorly. Eyes entirely lacking. Antennae four- or five-jointed. Anterior legs smaller than the others, all, however, extremely stout. No distinct sternal plate. Abdomen without pleural plates.

In this family are included all the Anopluran parasites of marine mammals, such as the seals and walruses, and all are adapted by a thick coating of spines or scales to the aquatic life of their hosts. Mjöberg has proposed to divide the group into two families with regard to the presence or absence of scales, but with this view we are hardly inclined to agree. The family is small, containing at present but seven species (we are adding an eighth), of which four occur in North America or Greenland.

Genus **ANTARCTOPHTHIRUS** Enderlein.

Antarctophthirus Enderlein, Zool. Anz., vol. 28, pp. 136-137, (1904).
Antarctophthirus Enderlein, Deutsche Südpolar Exped., vol. 10, pt. 4, pp. 476, 508, figs. 172-177, text fig. KK, NN, (1909).
Arctophtirus (in part) Mjöberg, Arkiv. för Zoologi, vol. 6, no. 13, p. 177, (1910).

Antennae five-segmented. Anterior legs and claws much smaller and slenderer than the others. Spiracles small, one pair on the mesothorax and on each of the third to eighth abdominal segments. Head, thorax and abdomen beset with more or less short, stout spines, and with long hairs. Abdomen beset with scales on both dorsal and ventral sides. Scales present, but much more sparingly, on the thorax. There are at present but four species in this genus: one, *A. trichechi* (Boh.), occurring upon walruses, in the Arctic regions, the other three occurring upon as many species of seals in the Antarctic. Mjöberg has proposed placing *A. trichechi* in a separate genus, *Arctophtirus,* but we are unable to understand his reasons for doing so. We have at hand specimens of this species and of another which is undoubtedly new.

Antarctophthirus trichechi (Boh).

Plate III, fig. 1; text fig. 17, *B*.

Haematopinus trichechi Boheman, Vetensk Akad. Forhandl. (Kopenhagen) 12, p. 577, pl. 35, fig. II, IIa and II$_b$ (1865).
Antarctophthirus trichechi Enderlein, Deutsche Südpolar Exped., vol. 10, pt. 4, pp. 505, 512-513, pls. 55-56, (1909).
Arctophtirus trichechi Mjöberg, Arkiv. för Zoologi, vol. 6, no. 13, pp. 177-180, (1910).

We have several specimens of this species, both males and females, taken from a "Pacific walrus" (northeast of Siberia) sent us by Professor Van Dyke of the University of California.

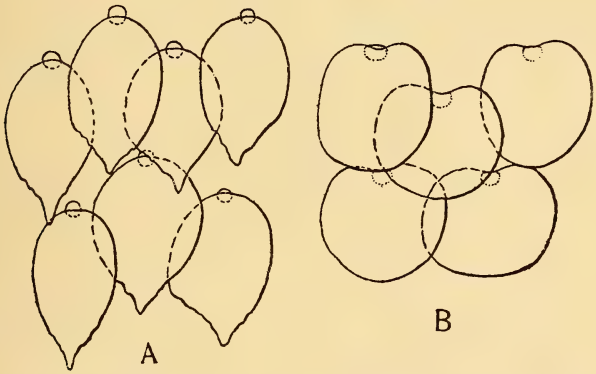

Fig. 17.—A, *Antarctophthirus monachus* n. sp., scales from abdomen.
B, *Antarctophthirus trichechi* (Boh.); scales from abdomen.

Antarctophthirus monachus n. sp.

Plate III, fig. 4; text fig. 17, *A*, and text fig. 18.

Among the material sent us by Professor Osborn are three specimens, two males and a female, of an undescribed species which we are referring to *Antarctophthirus*. The locality and exact host of the species are unknown, the specimens being labelled merely "On seal (?)." The species differs quite markedly from the others of the genus, being slenderer and much more spiny.

Description of the Female.—Total length 2.5 mm., length of head .5 mm., length of abdomen 1.6 mm., width of head .4 mm., width of thorax .5 mm., width of abdomen approximately 1 mm.

Head short and broad, the anterior margin slightly convex, the tem-

poral angles sharp and very prominent. Temporal margins nearly straight, diverging very slightly for a short distance, then converging to form the occiput. Occipital margin straight. Temporal margins with one short, stout spine, followed by two long stout hairs. A transverse row of six long spines across the occiput, with a median pair of short, stout spines. A distinct transverse row of six or eight very short, blunt spines just within the anterior margin, and numerous spines rather irregularly arranged about the head.

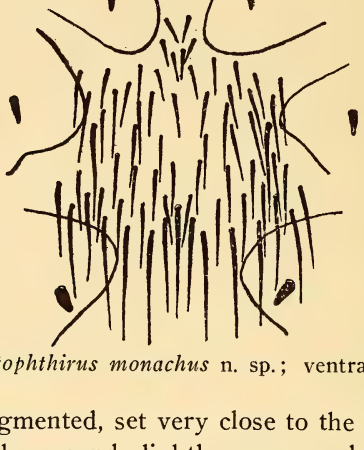

Fig. 18.—*Antarctophthirus monachus* n. sp.; ventral side of thorax.

Antennae five-segmented, set very close to the anterior margin; the first segment large, the second slightly narrower but about as long, the remainder successively shorter and narrower. Under side of the head with a raised median portion bearing numerous short, slender hairs, with a thick fringe of long, slender hairs about the lateral and posterior margins. Rostrum very short, close to the anterior margin.

Thorax only slightly wider and somewhat longer than the head, not widening posteriorly, entirely free from scales. Anterior margin with a slight V-shaped notch, the posterior margin nearly straight. Mesothorax with a median area bearing many short, blunt spines and rather long hairs, and with numerous spines and hairs along the lateral margins. Metathorax with an irregular, transverse row of eight to twelve stout hairs and several smaller ones. Legs very large and stout, the middle and posterior pair of nearly the same size, the anterior pair much smaller. No distinct sternal plate, the space between the coxae bearing many slender, irregularly arranged hairs, of which those at the posterior margin are longer and stouter than the remainder.

Abdomen elongated oval, slightly pointed posteriorly. First to third

segments with numerous short, stout spines, and with a transverse row of slender hairs along the posterior margin. Succeeding segments with a diminishing number of hairs and spines, these being replaced by small, thin scales, particularly along the lateral margins.

Ventral side thickly beset with short, stout spines, and with no scales except on the seventh and eighth segments, where the spines are almost entirely replaced by scales. Ninth segment and the posterior margin of the eighth with a great number of long, slender hairs.

Description of the Male.—Total length 2.4 mm., length of head .5 mm., length of abdomen 1.55 mm., width of head .4 mm., width of thorax .5 mm., width of abdomen 1.00 mm.

Closely resembling the female, except for the slightly more pointed abdomen. Ventrally almost entirely free from scales. Basal plate broad, more heavily chitinized at the margins than elsewhere. Parameres very short and slender. Penis large and bluntly pointed.

Genus **ECHINOPHTHIRIUS** Enderlein.

Echinophthirius Giebel, Zeitschr. für Ges. Naturw., vol. 37, p. 177, (1871).
Echinophthirius Enderlein, Zool. Anz., vol. 29, p. 661, (1906).
Echinophthirius Enderlein, Deutsche Südpolar Exped., vol. 10, pt. 4, p. 507, (1909).

Antennae four-segmented. Body entirely without scales. Head, thorax and abdomen beset with long, heavy spines.

Echinophthirius phocae (Lucas).

Reported by Osborn, as *E. setosus,* from harbor seals in the New York Aquarium.

In addition *Echinophthirius groenlandicus* (Becher), host *Phoca groenlandica,* and *Echinophthirius sericeus* Meinert, have been reported from Greenland.

V

DEGREE OF HOST PARASITIZATION.

In addition to a record of the hosts upon which parasite species have been found, it is very desirable to know also those host species which have been examined for parasites with negative results. In fact if we are to arrive at a proper understanding of the problems of species distribution among the parasites, then negative records are in many cases of an importance almost equal to the positive records. Even though repeated failures to find a certain parasite upon a certain host can never be regarded as absolute proof that that particular parasite does not occur upon that particular host, the record of such failures does at least give much aid in judging whether our positive records of the occurrence of a parasite species upon that host are to be accepted unquestioningly or are to be regarded with suspicion. While straggling, or the accidental occurrence upon a host species of a parasite not normal to it, is not a very common occurrence, it does sometimes happen. The appearance upon a carnivorous host of parasites normally found upon the prey of that host, or especially the transference of parasites from one host to another in the game-bag or on the skinning-table may, and in fact do, sometimes occur. In such cases, and in the case of parasites taken from skins in museums and from hosts which have been confined in zoological gardens, negative records, whenever available, are unquestionably of extremely great value. Because of these facts we are adding what may very well be called a negative host record, including only those host species which we ourselves have examined for parasites with negative results.

We have found no Mallophaga upon any of the *Sciuridae* represented by several species and many individuals of the genera *Sciurus, Eutamias, Citellus, Callospermophilus, Arctomys* and *Sciuropterus,* nor upon any of the *Muridae* represented by the genera *Peromyscus, Microtus, Phenacomys* and *Mus.* There have previously been isolated records of the occurrence of Mallophaga upon certain Sciurids, but the evidence indicates very strongly that neither the *Sciuridae* nor the *Muridae* normally possess a Mallophagan species.

We have found neither Mallophaga nor Anoplura upon any of the

following: the *Soricidae,* represented by *Sorex vagrans, S. montereyensis* and *Neosorex bendirei;* the *Talpidae,* represented by *Scapanus latimanus* and *Neurotrichus gibbsi;* the *Zapodidae,* represented by *Zapus orarius* and *Z. trinotatus alleni;* the *Aplodontidae,* represented by *Aplodontia phaea;* the *Didelphidae* (Marsupialia), represented by *Didelphys* sp. The number of individuals examined in each of the above cases is for the most part very small, ranging from three in the case of *Didelphys* sp. to twenty-five or thirty in the case of the two species of *Sorex.* For this reason it is extremely probable that some of these negative conditions will be changed by further investigation.

We have found no Anoplura, with the exception of one case previously discussed, on any of the *Mustelidae,* represented by two species of skunks, *Mephitis occidentalis* and *Spilogale phenax,* one species of badger, *Taxidea taxus,* and one species of weasel, *Putorius xanthogenes mundis.* The *Felidae,* represented by two or three individuals of one species, *Lynx californicus,* and the *Geomyidae,* represented by perhaps a hundred individuals of several species of the genus *Thomomys,* have likewise produced no Anoplura. All these species, however, are represented in the Mallophagan host list.

A few observations in regard to the occurrence of parasites upon the individual hosts may perhaps be of some interest. Mjöberg has stated that in general but one species of Anoplura occurs upon any host species; but this is by no means always the case. Many of the *Sciuridae* are regularly parasitized by two species of Anoplura, and probably sometimes even by three; and the various species of the genus *Microtus,* of the *Muridae,* is regularly parasitized by two species. The white-footed mice of the genus *Peromyscus* likewise harbor two Anopluran species, altho one of these is evidently rather rare. It is, however, an interesting fact, whether of any significance or not, that those host species which are the most heavily parasitized by Mallophaga do not harbor any Anoplura; and the reverse is also true. The *Sciuridae* and *Muridae,* which collectively harbor four or five genera and numerous species of Anoplura, do not seem to possess a single Mallophagan species; and the *Mustelidae* and *Geomyidae,* which have several species of Mallophaga and are individually very heavily parasitized, apparently do not normally possess any Anoplura.

The degree of parasitization of the individual hosts is extremely variable; but in general it may be said that hardly half of the host individuals of a parasitized host species are sufficiently infested to permit of finding the parasites; indeed in many cases the percentage is even small-

er. Out of perhaps fifteen rabbits representing two species of different genera, which we have examined, but one was found to be parasitized. Attempts to correlate the presence or absence of parasites with the life habits of the hosts have thus far proven entirely unsuccessful. It might be surmised that the host species which hibernate for long periods, with a very marked decrease in their body temperature, or those species which spend a large part of their life in water, would be free from parasites; yet this is not at all the case. The Point Barrow ground squirrel, which must hibernate for more than half its life, and the various species of seals and walruses, are not at all lacking in uninvited guests.

VI

NORTH AMERICAN MALLOPHAGA FROM MAMMALS

The list of the Mallophaga recorded from American mammals (including the records of this paper) comprises twenty-seven species, of which nine occur upon domesticated hosts.

These twenty-seven species are distributed among five genera, of which four—*Heterodoxus, Trimenopon, Gliricola* and *Gyropus*—are represented by a single species each. The other species all belong to the genus *Trichodectes,* which, as a matter of fact, includes four-fifths of all the mammal-infesting Mallophaga. (In a recent paper, "Ectoparasites of Mammals," published in the American Naturalist, vol. 48, pp. 257-279, 1914, the senior author discusses in some detail the interesting conditions of the generic distribution of Mallophaga among the mammals.)

The species of the genus *Trichodectes* find their hosts among such extremely diverse mammals—diverse as to habits as well as phylogeny—as gophers, beavers, pocket-rats, skunks, badgers, porcupines, cats, dogs, horses, cattle, goats, sheep, deer, and even monkeys. Yet in spite of this wide range of hosts, the genus is remarkably homogeneous, there being but little breaking up of the species into particular groups associated with particular groups of phyletically or habit-related hosts.

In this respect the mammal-infesting Mallophaga present a striking and interesting contrast with the other group of permanent ectoparasites of mammals, that is, the Anoplura. Among these latter there is an extremely pronounced breaking up into groups—groups fairly characterized as distinct genera, sub-families and even families—the species of each of which are characteristic of certain restricted groups of hosts. It is, indeed, a rule almost without exception that any single Anopluran genus is confined to a single host order, or even to a single host family.

It is probable that a closer study of the mammalian Mallophaga will warrant some breaking-up of the large genus *Trichodectes* into three or four lesser genera; one or two students have made a beginning of such an analysis. But the possibilities of such a breaking-up are limited; the plain truth is, that the differentiation and heterogeneous specialization of the Anoplura is far and away beyond that of the Mallophaga.

However, such a condition is but the one to be expected. It should

be not at all surprising that parasites which come into such more intimate relations with their hosts as do the blood-sucking ones (the Anoplura) as compared with the hair and dermal-scale feeding ones (the Mallophaga) should reveal a much more exact fitting to their host, involving structural and physiological specialization.

Although in listing in the following pages all the species of *Trichodectes* so far recorded from North American mammals we have believed it advisable to indicate our belief that certain species are only synonyms of certain others, we have by no means attempted to make a complete revision of the North American species of the genus. This undertaking we may postpone until a planned attempt to make a revision of the whole genus as at present known from both New World and Old World records can be taken up.

VII.

DESCRIPTIONS OF NEW SPECIES, AND DETERMINATIONS OF OLD SPECIES OF MALLOPHAGA.

Genus **TRICHODECTES** Nitzsch.

Antennae three-segmented; tarsi with one claw, infesting mammals only. The only genus in the family *Trichodectidae.*

This genus, as stated above, is found upon a wide variety of hosts. An attempt has recently been made to break it up, Mjöberg having proposed a genus, *Eutrichophilus,* for certain species found upon porcupines and deer. The attempt, however, is not very convincing. There are between fifty and sixty known species, of which twenty-three have been recorded from North America.

Trichodectes parumpilosus Piaget.

Trichodectes parumpilosus Piaget, Les Pediculines, p. 397, pl. 32, fig. 5, (1880).

This species is apparently very common on the domestic horse. We have numerous specimens, and it has previously been reported by Osborn. Another species, *T. pilosus* Giebel, has also been described from horses, but has not yet been reported from North America.

Trichodectes scalaris Nitzsch.

Trichodectes scalaris Nitzsch, in Giebel, Ins. Epiz., p. 61, pl. 3, fig. 7, 9, (1874).

Occurs on domestic cattle. It has been reported by Osborn, and we also have specimens.

Trichodectes climax Nitzsch.

Trichodectes climax Nitzsch, Germar's Mag., vol. 3, p. 296, (1818).
Trichodectes limbatus Gervais, Hist. Ins. Aptéres, vol. 3, p. 313, pl. 7, fig. 1, (1848).

An extremely common parasite of domestic goats. Another species, *T. limbatus* Gervais, has also been described from goats; but we are inclined to believe with Osborn that the two species are identical.

Trichodectes hermsi Kellogg & Nakayama.

Trichodectes hermsi Kellogg & Nakayama, Psyche, vol. 22, (in press, 1915).

Described from specimens taken from Angora goats at Inverness, Marin county, Calif. It is easily distinguishable from *T. climax* by its large size and the numerous short, spiny hairs irregularly disposed on the head and abdomen, in this respect resembling *T. pilosus*. However, it differs from *T. pilosus* in being considerably larger and in the marked disparity in the size of the male and female.

Trichodectes latus Nitzsch.

Trichodectes latus Nitzsch, in Giebel, Ins. Epiz., p. 53, pl. 3, figs. 2, 3, (1874).

Occurs upon the domestic dog. It is said by Osborn to be of rather common occurrence, but we have not met with it.

Trichodectes subrostratus Nitzsch.

Trichodectes subrostratus Nitzsch, in Giebel, Ins. Epiz., p. 55, pl. 3, fig. 5, (1874).

This is a well known parasite of the domestic cat, and is apparently normal to wildcats also. It has been recorded by Paine from a wildcat, *Lynx californicus* (San Gregorio, Calif.), and we have specimens taken from the same host at Gualala, Mendocino county, Calif.

Trichodectes sphaerocephalus Nitzsch.

Trichodectes sphaerocephalus Nitzsch, in Giebel, Ins. Epiz., p. 60, (1874).

Reported by Osborn as common upon sheep at Ames, Iowa. We have not yet met with it.

Trichodectes tibialis Piaget.

Trichodectes tibialis Piaget, Les Pediculines, p. 299, pl. 32, fig. 6, (1880).

Osborn referred to this species, specimens taken from "black-tailed deer," and we have specimens from *Odocoileus columbianus* (Covelo and Gualala, Calif.). It is rather doubtful that this is the same as the European species.

Trichodectes parallelus Osborn.

Trichodectes parallelus Osborn, Bul. 5, o. s. U. S. Dept. Agr., Div. Ent., pp. 240-241, fig. 148, (1891).

Described by Osborn from specimens from deer, probably *Cariacus*

virginianus. We have specimens from "red deer," (Michigan). It may easily be distinguished from *T. tibialis* by the abdomen, which is slender and much narrower than the head.

Trichodectes (Eutrichophilus) mazama Stobbe.

Eutrichophilus mexicanus Mjöberg, Arkiv. för Zoologi, vol. 6, pp. 79-82, (1910). Specific name preoccupied.
Eutrichophilus mazama Stobbe, Deut. Ent. Zeit., p. 562, (1913).

Described from specimens in the Hamburg Zool. Mus. taken from *Cervus mexicana* (Mexico). It apparently differs from the two preceding species chiefly in the very large first antennal segment of the male.

Trichodectes (Eutrichophilus) setosus Giebel.

Trichodectes setosus Giebel, Ins. Epiz., p. 56, (1874).
Eutrichophilus setosus Mjöberg, Arkiv. för Zoologi, vol. 6, p. 73, (1910).

This species is apparently common to the porcupines of both Europe and America. Osborn has recorded it from *Erethizon dorsatum* (Nebraska), and we have specimens from *Erethizon epixanthum* (California and Alaska). Mjöberg has described three species, *T. (Eutr.) minor, T. (Eutr.) cordiceps,* and *T. (Eutr.) cercolabes,* all from *Coëndu (Cercolabes) prehensilis,* a South American porcupine. It is indeed most extraordinary to find three closely related species of Mallophaga upon the same host, and Neumann is of the opinion that they are merely forms of *T. setosus.* Stobbe, however, has examined Mjöberg's material, and in addition to agreeing with Mjöberg has added still a fourth species from another host of the same genus. In addition to these there is still a fifth species, *T. mexicanus* Rudow from *Coëndu novae-hispaniae,* making five species described from the same host genus and six from this one small family. It is all rather bewildering.

Trichodectes mexicanus Rudow.

Trichodectes mexicanus Rudow, Zeit. f. ges. Naturw., vol. 27, pl. 6, fig. 2, (1876).

From *Coëndu (Cercolabes) mexicanus,* a Mexican porcupine.

Trichodectes (Eutrichophilus) coëndu Stobbe.

Eutrichophilus coëndu Stobbe, Ent. Zeit., pp. 566-567, (1913).

From *Coëndu novae-hispaniae,* a Mexican porcupine.

Trichodectes geomydis Osborn.

Plate VIII, figs. 1, 3 and 6.

Trichodectes geomydis Osborn, Bul. 7, n. s. U. S. Dept. Agr., Div. Ent., p. 54, fig. 42, (1896).
Trichodectes californicus Chapman, Ent. News, vol. 8, pp. 186-187, pl. 9, (1897).
Trichodectes californicus Paine, Ent. News, vol. 23, p. 440, pl. 20, fig. 2, (1912).

Specimens from *Thomomys bottae laticeps* (California) and *Thomomys* sp. (S. Yolla Bolly Mt., Tehama county, California). The species has previously been recorded from *Thomomys* species in California, *Geomys bursarius* from Iowa, and a Central American Geomyid, *Macrotomys heterodus,* from Costa Rica. It has been stated that the species is closely related to *T. mephitidis* Osborn; yet the two are really quite different, the projection on the posterior margin of the first antennal segment of the male and the stout antennae of the female, distinguishing *T. geomydis* at once; and any revision of the genus would probably place these two species in separate subgenera, at least.

The examination of the types of *Trichodectes californicus* Chapman has convinced us that this species cannot be considered as distinct from *T. geomydis. T. californicus* has been reported from *Perognathus* sp. (Baja California) and *Dipodomys merriami* (Arizona).

Trichodectes castoris Osborn.

Trichodectes castoris Osborn, Bul. 5, n. s. U. S. Dept. Agr., Div. Ent., p. 241, fig. 149, (1896).

From beaver, *Castor castoris.* We have not seen this species. Osborn states that it is very similar to both *T. geomydis* and *T. mephitidis,* but that "the shallowness of the frontal hollow distinguishes it easily from *geomydis,* and the form of the head and greater length of the antennae from *mephitidis.*"

Trichodectes mephitidis Osborn.

Plate VIII, figs. 2, 4, 5.

Trichodectes mephitidis Osborn, Bul. n. s. U. S. Dept. Agr., Div. Ent., p. 242, fig. 150, (1896).
Trichodectes minutus Paine, Ent. News, vol. 23, pp. 439-440, pl. 20, fig. 4, (1912).

Numerous specimens from *Mephitis occidentalis* (San Hedrin Mt. and Palo Alto, Calif.), *Spilogale phenax* (Marin county, Calif.), *Mephitis*

macrura (Arizona), and *Putorius xanthogenes* (Point Arena, Calif.). This species was originally described from specimens taken from *Mephitis mephitica* (Nebraska) and *Spilogale interrupta* (Iowa). It has also been recorded from a South American skunk (Choro, Bolivia), this record, however, being erroneous; and also from a Bornean mustelid, *Halictis everetti,* this record, too, probably being erroneous.

Quite recently Paine has described a species, *T. minutus,* from a weasel, *Putorius noveboracenis,* which we are inclined to regard as a synonym of *T. mephitidis.* We do not have specimens of *T. minutus,* but we do have numerous specimens from weasels which are undoubtedly *T. mephitidis,* and also agree very well with the description of *T. minutus.* There are indeed some differences between the specimens from the different hosts, but not sufficient to warrant regarding them as representing distinct species.

Trichodectes crassus Nitzsch.

Plate VII, fig. 4.

Trichodectes crassus Nitzsch, in Giebel, Ins. Epiz., p. 54, (1874).

This species has been recorded from the Old World badger, and Osborn has recorded it with some doubt from an American raccoon, *Procyon psora.* A German record also attributes *T. crassus* to a raccoon (in some zoological garden); but since the raccoons harbor another very distinct species, *T. octomaculatus* Paine, we are much inclined to doubt these records. Our figure is from specimens which we have received from Europe, and is inserted for the sake of comparison with the other species from Mustelids.

Trichodectes interrupto-fasciatus n. sp.

Plate VII, figs. 1, 2 and 3.

Trichodectes mephitidis (in part) Kellogg, Amer. Nat., vol. 48, p. 269, (1914).

Several males and females from a badger, *Taxidea taxus,* (South Yolla Bolly Mt., Tehama county, Calif.), and also several males and females from a skunk, (Choro, Bolivia, South America). The latter specimens have been previously recorded as *T. mephitidis* Osborn.

This species is one of a fairly well defined carnivore-infesting group which includes *T. latus,* from the domestic dog, *T. vulpis,* from European foxes, *T. crassus,* from the European badger, and *T. mephitidis,* from

skunks. It differs markedly from *T. crassus* in the much more rounded temples of the male, and apparently is closest to *T. mephitidis*. It differs from the latter chiefly in being much larger, in having the anterior margin of the head much less rounded, and in the character of the genitalia of the male. While it is rather peculiar to find the same species upon a North American badger and a South American skunk, the specimens from the two hosts agree in practically every detail.

Description of the Female.—Total length 1.57 mm., length of head, .425 mm., length of prothorax .11 mm., length of metathorax .09 mm., length of abdomen .95 mm., width of head across temple .675 mm., width of prothorax .425 mm., width of metathorax .535 mm., width of abdomen .9 mm.

Head slightly wider than long and with the anterior margin but slightly rounded, with a very shallow median notch, and produced into prominent, trabecula-like process in front of each antenna. Antennal sinuses rather small and shallow. Ocular projections prominent, extending well beyond the temples, which are rounded and meet the occipital margin with a slight angle. Occipital margin nearly straight, slightly emarginate at the points where it is met by the occipital bands. Antennal bands broad and very dark, separated from each other at the front of the head by a very small clear space, and interrupted across the base of the antennae, not reaching the ocular blotch. Occipital bands very short, connected at their bases by a broad band. Anterior margin and temples with several short hairs, the posterior margin with one long hair near the temporal angle. Antennae rather small, not reaching the posterior margin of the head. First and third segments of nearly the same length, the second segment a little shorter.

Prothorax very short and broad, and with the posterior margin slightly convex. A single short spine at each posterior lateral angle, and one on each side of the meson on the posterior margin. Mesothorax a trifle shorter than the prothorax and somewhat broader, the lateral margins curved and converging slightly, the posterior margin slightly convex except for a slight median emargination. Lateral margin with three or four short spines, posterior margin with a median group of eight spines. Legs normal.

Abdomen elliptical in shape, only a little longer than wide, and with a narrow, hyaline band along the lateral margin. First segment with a median group of eight or nine spines. Second to fourth segments each with transverse row of spines divided into three distinct groups, the median group consisting of eight to twelve spines, and each lateral group of

six to eight spines. Fifth to seventh segments each with a continuous transverse row of about thirty spines. Eighth segment with a median group of four spines and a single spine near each posterior-lateral angle. Ninth segment with several short spines along the lateral margins; the succeeding segments, except the ninth, each with a pair of spines near the middle of the lateral margin of the segment, these spines on the seventh and eighth segments being longer than on the others.

Description of the Male.—Total length 1.55 mm., length of head .375 mm., length of prothorax .15 mm., length of metathorax .075 mm., length of abdomen .95 mm., width of head across temples .5 mm., width of prothorax .35 mm., width of metathorax .4 mm., width of abdomen .75 mm.

Head with the anterior margin nearly straight, with no median notch, and produced into trabecula-like processes in front of the antennae. Antennal sinuses deep and sharply angular. Ocular projections small, not extending beyond the extreme margin of the temples, which are smoothly rounded and meet the occipital margin without an angle. Occipital margin nearly straight, slightly emarginate where it is met by the occipital bands. Antennal bands narrow, widening somewhat at the front of the head, where they are separated from each other only by a very small clear area, and interrupted across the base of the antennae, not reaching the ocular blotch. Occipital bands short, united at their bases by a narrow band. Several short hairs on the anterior margin and temples, and one rather long hair on each side of the occipital margin.

Antennae large and backward-pointing, reaching somewhat beyond the occipital margin of the head; the first joint large and as long or perhaps a trifle longer than the second and third combined. Third joint a little longer than the second, both being slightly curved. First joint with a row of four short spines on the dorsal side, second and third joints with several rather long hairs, the third with two short teeth on the inner margin at the distal end.

Thorax about one and one-fourth times as wide as long. Prothorax trapezoidal in shape, widest across the posterior margin, which is nearly straight, and with a short spine at each posterior margin. Metathorax about half as long as the prothorax and a trifle wider, the lateral margins curved, converging slightly, and bearing several short spines, the posterior margin nearly straight but with a slight median emargination and with a median group of six spines. Legs normal.

Abdomen oval, widest across the anterior margin of the fourth segment and with a narrow hyaline band at the margins. First segment with

a median group of six spines on the posterior margin. Second to seventh segments each with a transverse row of spines divided into three distinct groups, the median group containing from six to eight spines and each lateral group five to seven spines. Eighth segment with a continuous transverse row of ten or twelve spines. Ninth segment with numerous short spines at the tip. First and second segments with several short spines along the lateral margins, the second to eighth segments each with a pair of spines near the middle of the lateral margin, those on the seventh and eighth segments being longer than the others. On the ventral side the spines in the transverse rows are more numerous, there being from twelve to fourteen in the median groups.

Genitalia conspicuous, the basal plate consisting of two chitinous bars which are widened and thickened at their posterior ends. Penis long and stout, the arms not diverging widely and being but slightly longer than the shaft. Beneath the penis a short, cuneiform, backward-pointing plate, with the posterior end deeply bifid.

Trichodectes retusus Nitzsch.

Trichodectes retusus Nitzsch, in Giebel, Ins. Epiz., p. 55, pl. 3, fig. 4, (1874).

Reported by Osborn from a weasel (Ames, Iowa). It was originally described from an Old World weasel.

Trichodectes octomaculatus Paine.

Trichodectes octomaculatus Paine, Ent. News, vol. 32, pp. 438-439, pl. 20, fig. 1, (1912).

Trichodectes procyonis Neumann, Arch. de Parasit., vol. 15, pp. 624-626, fig. 14, (1913).

This species was described from a raccoon, *Procyon psora* (Stanford University, Calif.), and we have since met with it on the same host. We have not seen specimens of Neumann's *T. procyonis,* but the comparison of our specimens with his description and figure has convinced us that *T. procyonis* is identical with *T. octomaculatus.* Neumann's specimens were from *Procyon lotor* (British Columbia).

Trichodectes quadraticeps Chapman.

Trichodectes quadraticeps Chapman, Ent. News, vol. 8, p. 185, fig., (1887).

Specimens from *Urocyon cinereo-argenteus sequoiensis* (Freestone, Sonoma county, Calif.). Originally described from specimens taken from the same host.

Trichodectes pallidus Piaget.

Trichodectes pallidus Piaget, Les Pediculines, p. 405, pl. 32, fig. 9, (1880).

From *Nasua narica* (Zool. Garden, Rotterdam). The host is a native of Mexico and Central America.

Trichodectes nasuatis Osborn.

Trichodectes nasuatis Osborn, Ohio Natur., vol. 2, p. 178, pl. 1, fig. 3, (1902).

From *Nasua narica* (Central America). It is extremely likely that this is the same as *T. pallidus* Piaget.

Trichodectes painei Kell. & Nak.

Trichodectes painei Kellogg & Nakayama, Psyche, vol. 21, pp. 90-92, fig. 1, (1914).

From unknown host (Baja California). It is easily recognizable by the extremely long claws and the emarginate posterior margin of the second abdominal tergite of the male.

Trichodectes thoracicus Osborn.

Trichodectes thoracicus Osborn, Ohio Natur., vol. 2, p. 178, pl. 2, fig. 4, (1902).

From *Bassariscus astuta* (California).

Genus **GYROPUS** Nitzsch.

Gyropus Nitzsch, Germar's Mag., vol. 3, p. 302, (1818).

Antennae concealed beneath the head, four-segmented, the fourth segment very large; temples produced into angulated processes, mouthparts on the frontal margin of the head. Tarsi with one claw, which is well developed. Occuring exclusively upon mammals.

The members of this genus occur upon animals all of which are native to South America, although one of its hosts, the common guinea-pig, is now found in all parts of the world.

Gyropus ovalis Nitzsch.

Gyropus ovalis Nitzsch, Germar's Mag., vol. 3, p. 304, (1818).

Common upon the ordinary guinea-pig.

Genus **GLIRICOLA** Mjöberg.

Gliricola Mjöberg, Arkiv. för Zoologi, vol. 13, p. 18, (1910).

Very close to Gyropus, differing chiefly from that genus in having the claws very much reduced in size.

Gliricola porcelli (Schrank).

Pediculus porcelli Schrank, Enumeratio insectorum, Austriae indigenorum, p. 500, pl. 1, fig. 1, (1781).
Gyropus gracilis Nitzsch, Germar's Mag., vol. 3, p. 304, (1818).
Gliricola gracilis Mjöberg, Arkiv. för Zoologi, vol. 6, p. 20, (1910).
Gyropus porcelli Neumann, Bul. Zool. Soc. de France, vol. 37, pp. 213-216, figs. 1 and 2, (1912).
Gyropus bicaudatus Paine, Ent. News, vol. 23, p. 441, pl. 20, figs. 3 and 3*c*, (1912).
Gliricola porcelli Stobbe, Deut. Ent. Zeit., p. 117, (1914).

Extremely common upon the ordinary guinea-pig.

Genus **TRIMENOPON** Cummings.

Trimenopon Cummings, Bul. Ent. Res., vol. 4, pp. 39-40, (1913).

Antennae five-jointed, concealed in fossae beneath the head. Tarsi with two claws. Pronotum with well developed lateral wings. Head and thorax together nearly as long as the abdomen.

Trimenopon jenningsi (Kellogg & Paine).

Menopon jenningsi Kellogg & Paine, Ent. News, vol. 21, pp. 461-462, fig. 1, (1910).
Trimenopon echinoderma Cummings, Bul. Ent. Res., vol. 4, fig. 4, (1913).
Trimenopon jenningsi Stobbe, Deut. Ent. Zeit., p. 177, (1914).

Originally described from a tame guinea-pig, *Cavia cobaya* (Panama Canal Zone), and later recorded from wild guinea-pigs from South America.

Genus **HETERODOXUS** Le Souef & Bullen.

Heterodoxus Le Souef & Bullen, Victorian Nat., vol. 18, p. 159, (1902).
Heterodoxus Paine, Ent. News, vol. 23, pp. 360-361, (1912).

Antennae four-segmented, concealed beneath the head. Head conical, broader than long, front rounded, sides straight, ocular emarginations lacking. Thorax well developed, the mesothorax present but quite small. Tarsi with two claws.

Heterodoxus longitarsus (Piaget).

Menopon longitarsus Piaget, Les Pediculines, p. 504, pl. 41, fig. 7, (1880).
Heterodoxus macropus Le Souef & Bullen, Victorian Nat., vol. 18, p. 159, (1902).
Menopon spiniger Enderlein, Anopluren u. Mallophagen, Schultz, Forschungsreise in Südafrika; Jenais. Denkschr., vol. 14, pp. 80-81, (1909).
Heterodoxus longitarsus Neumann, Arch. de Parisitologie, vol. 15, p. 634, (1913).

This species was originally described from a species of kangaroo, and there are several other records of its occurrence upon kangaroos. Yet it has also been recorded from the domestic dog, once from Africa, once from Formosa and once from California. However, it is extremely probable that kangaroos are its normal hosts and the other records are due to straggling from kangaroos in museums and zoological gardens, for it certainly is not of common occurrence upon dogs.

Note.—While this paper is passing through the press we have received numerous specimens of *H. longitarsus* taken from a dog at San Francisco, Calif.

VIII

MAMMALIAN HOST LIST OF NORTH AMERICAN ANOPLURA AND MALLOPHAGA

The orders and families are arranged as in Beddard's "Mammalia," 1902. The synonomy of the hosts has been worked out from the "List of North American Land Mammals in the United States National Museum," 1911.

Order UNGULATA.

Family EQUIDAE

Equus caballus (Horse).
*(A) *Haematopinus asini* (Linné).
*(M) *Trichodectes parumpilosus* Piaget.
Equus asinus (Donkey).
(A) *Haematopinus asini* (Linné).

Family SUIDAE

Sus scrofa domestica (Domestic Pig).
(A) *Haematopinus suis* L.

Family CERVIDAE

Cervus mexicanus (Southern Mexico).
(M) *Trichodectes (Eutrichophilus) mazama* Stobbe (Zool. Gard. Hamb.).
Cariacus virginianus (Virginia Deer).
(M) *Trichodectes parallelus* Osborn.
"Cearrus-Hirsch."
(A) *Linognathus breviceps* Piaget (?) (Guatemala).
Red Deer.
(M) *Trichodectes parallelus* Osborn (Michigan).
Black-tailed Deer (Northern and Western U. S.).
(M) *Trichodectes tibialis* Piaget.
Odocoileus columbianus.
Trichodectes tibialis Piaget (California).
Odocoileus hemionus (Western United States).
(M) *Trichodectes tibialis* Piaget (Zool. Gard. Berlin).

*(A) indicates an Anopluran species, (M) a Mallophagan one.

Family BOVIDAE.

Bos taurus (Domestic Cow).
(A) *Haematopinus eurysternus* Nitzsch.
(A) *Linognathus vituli* (Linné).
(M) *Trichodectes scalaris* Nitzsch.
Bos americanus (Bison).
(A) *Haematopinus tuberculatus* (Burmeister).
Ovis aries (Domestic Sheep).
(A) *Linognathus pedalis* (Osborn).
Capra hircus (Domestic Goat).
(A) *Linognathus stenopsis* (Burm.).
(M) *Trichodectes climax* Nitzsch.
Angora Goat.
(M) *Trichodectes climax* Nitzsch.
(M) *Trichodectes hermsi* Kellogg & Nakayama (California).

Order CARNIVORA

Family FELIDAE

Felis domestica (Domestic Cat).
(M) *Trichodectes subrostratus* Nitzsch (California).
Lynx californicus (Wild Cat).
(M) *Trichodectes subrostratus* (California).

Family CANIDAE.

Canis familiaris (Domestic Dog).
(A) *Linognathus piliferus* (Burm.).
(M) *Trichodectes latus* Nitzsch.
(M) *Heterodoxus longitarsus* (Piaget).
Urocyon cinereoargenteus sequoiensis (Fox).
(M) *Trichodectes quadraticeps* Chapman (California).
Urocyon cinereoargenteus.
(M) *Trichodectes quadraticeps* Chapman (California).
Procyon lotor (Raccoon).
(M) *Trichodectes crassus* Nitzsch.
(M) *Trichodectes octomaculatus* Paine (British Columbia).
Procyon psora (Western Raccoon).
(M) *Trichodectes octomaculatus* Paine (California).

Bassariscus astuta (Ring-tailed Cat).

(M) *Trichodectes mephitidis* Osborn (California).

(M) *Trichodectes thoracicus* Osborn (California; Berlin Museum).

Nasua narica (Coati).

(M) *Trichodectes nasuatis* Osborn (Costa Rica).

(M) *Trichodectes pallidus* Piaget.

Family MUSTELIDAE.

Taxidea taxus (Badger).

(M) *Trichodectes interrupto-fasciatus* Kellogg & Ferris (California).

Putorius ermineus (Ermine).

(M) *Trichodectes retusus* Nitzsch.

Putorius noveboracensis.

(M) *Trichodectes mephitidis* Osborn (Illinois).

Putorius xanthogenes mundis.

(M) *Trichodectes mephitidis* Osborn (California).

Putorius vison.

(M) *Lipeurus dissimilis* Piaget (North Carolina).
(Probably straggler from bird prey.)

Mephitis mephitica (Skunk).

(M) *Trichodectes mephitidis* Osborn (Nebraska).

(M) *Goniodes mephitidis* Packard.
(Probably a straggler from bird prey.)

Mephitis occidentalis.

(M) *Trichodectes mephitidis* Osborn (California).

(A) *Neohaematopinus pacificus* Kellogg & Ferris.
(Probably straggler from chipmunk prey.)

Mephitis macrura.

(M) *Trichodectes mephitidis* Osborn (S. W. United States and Mexico).

Spilogale interrupta (Spotted Skunk).

(M) *Trichodectes mephitidis* Osborn (Iowa).

Spilogale phenax.

(M) *Trichodectes mephitidis* Osborn (California).

Weasel.

(M) *Trichodectes retusus* Nitzsch (Iowa).

Mink.

(M) *Trichodectes retusus* Nitzsch.

Family TRICHECHIDAE.

Trichechus rosmarus.

(A) *Antarctophthirus trichechi* (Boh.) (Davis Straits, Frobisher Bay).

Pacific Walrus.

(A) *Antarctophthirus trichechi* (Boh.) (Northeast of Siberia).

Family PHOCIDAE.

Phoca groenlandica.

(A) *Echinophthirus groenlandicus* Becker (Greenland).

(A) *Echinophthirus phocae* Lucas.

Phoca vitulina.

(A) *Echinophthirus phocae* Lucas.

Harbor Seal.

(A) *Echinophthirus setosus* (= *phocae*) Lucas (Aquarium, N. Y.).

Seal.

(A) *Antarctophthirus monachus* Kellogg & Ferris.

Order RODENTIA.

Family SCIURIDAE.

Sciurus cinereus.

(A) *Linognathoides montanus* (Osborn) (Colorado).

Sciurus cinereus var. *ludovicianus.*

(A) *Neohaematopinus antennatus* (Osborn) (Iowa).

Sciurus douglasi (Douglas Squirrel).

(A) *Neohaematopinus antennatus* (Osborn) (California).

(A) *Hoplopleura arboricola* Kellogg & Ferris (California).

Sciurus griseus.

(A) *Neohaematopinus antennatus* (Osborn) (California).

Hoplopleura arboricola Kellogg & Ferris (California).

Sciurus fossor nigripes.

(A) *Neohaematopinus antennatus* (Osborn) (California).

Western Gray Squirrel.

(A) *Enderleinellus longiceps* Kellogg & Ferris (Nebraska).

(A) *Neohaematopinus antennatus* (Osborn) (Nebraska).

Spermophilus columbianus = *Citellus columbianus.*

(A) *Linognathoides montanus* (Osborn) (Washington).

Citellus beecheyi douglasi.

(A) *Linognathoides montanus* (Osborn) (California).

(A) *Enderleinellus osborni* Kellogg & Ferris (California).

Spermophilus franklini = *Citellus franklini.*

(A) *Enderleinellus suturalis* (Osborn) (Iowa).

Spermophilus tridecemlineatus = *Citellus tridecemlineatus.*

(A) *Enderleinellus suturalis* (Osborn) (Iowa).

Callospermophilus chrysodeirus trinitatus.

(A) *Enderleinellus suturalis* var. *occidentalis* Kellogg & Ferris (California).

"Rock Squirrel."

(A) *Linognathoides montanus* (Osborn) (Colorado).

Citellus barrowensis (?)

(A) *Linognathoides montanus* (Osborn) (Pt. Barrow, Alaska).

Spermophilus sp. = *Citellus mexicanus (?).*

(A) *Linognathoides montanus* (Osborn) (Guanajuato, Mexico).

Arctomys sp. (Marmot).

(A) *Linognathoides montanus* (Osborn) (Oregon).

Tamias striatus.

(A) *Hoplopleura (?) erratica* (Osborn) (Iowa).

Sciuropterus volucella (Flying Squirrel).

(A) *Neohaematopinus sciuropteri* (Osborn) (Iowa).

(A) *Hoplopleura trispinosa* Kellogg & Ferris (Maryland).

Sciuropterus sp.

(A) *Neohaematopinus sciuropteri* (Osborn) (California).

(A) *Hoplopleura trispinosa* Kellogg & Ferris (California).

Eutamias hindsi (Chipmunk).

(A) *Hoplopleura arboricola* Kellogg & Ferris (California).

(A) *Neohaematopinus pacificus* Kellogg & Ferris (California).

Eutamias townsendi ocrogenys.

(A) *Hoplopleura arboricola* Kellogg & Ferris (California).

(A) *Neohaematopinus pacificus* Kellogg & Ferris (California).

Family MURIDAE.

Epimys norvegicus (Domestic Rat).

(A) *Polyplax spinulosa* (Burm.) (California).

Microtus californicus (Meadow Mouse).

(A) *Polyplax spinulosa* (Burm.) (California).

(A) *Hoplopleura acanthopus* var. *americanus* (California).

Microtus mordax.

(A) *Polyplax spinulosa* (Burm.) (California; Iowa).

Arvicola sp. = *Microtus* sp.

(A) *Hoplopleura acanthopus* var. *americanus* (Iowa).

Arvicola sp. = *Microtus* sp.
(A) *Hoplopleura (?) erratica* (Osborn).
Phenacomys sp.
(A) *Polyplax spinulosa* (Burm.) (California).
Hesperomys leucopus = *Peromyscus leucopus.*
(A) *Hoplopleura hesperomydis* (Osborn) (Iowa).
Peromyscus maniculatus rubidus (California).
(A) *Polyplax auricularis* Kellogg & Ferris.
(A) *Hoplopleura hesperomydis* (Osborn) (California).
Peromyscus sitchensis prevostensis (Alaska).
(A) *Polyplax auricularis* Kellogg & Ferris.
Neotoma cinerea occidentalis (Wood Rat).
(A) *Linognathoides inornatus* Kellogg & Ferris (California).

Family CASTORIDAE.

Castor castoris (Beaver).
(M) *Trichodectes castoris* (Osborn).

Family GEOMYIDAE.

Geomys bursarius (Pocket Gopher).
(A) *Haematopinoides squamosus* Osborn (Iowa).
(M) *Trichodectes geomydis* Osborn (Iowa).
Thomomys bottae (Pocket Gopher).
(M) *Trichodectes geomydis* Osborn (California).
Thomomys sp.
(M) *Trichodectes geomydis* Osborn (California).

Family HETEROMYIDAE.

Perognathus sp. (Spiny Haired Pocket Mouse).
(M) *Trichodectes geomydis* Osborn (Baja California).
Dipodomys merriami (Pocket Rat).
(M) *Trichodectes geomydis* Osborn (Arizona).
Dipodomys californicus.
(A) *Fahrenholzia pinnata* Kellogg & Ferris.

Family CAVIIDAE.

Cavia cobaya (Guinea-pig).
(M) *Gliricola gracilis* (Nitzsch).
(M) *Gyropus ovalis* Giebel.

Family CERCOLABIDAE.

Cercolabes mexicanus.

(M) *Trichodectes mexicanus* Rudow (Mexico).

(M) *Trichodectes coendu* Stobbe (Zool. Mus. Berlin).

Erethizon epixanthum (Porcupine).

(M) *Trichodectes setosus* Giebel (California).

Erethizon dorsatum.

(M) *Trichodectes setosus* Giebel (Nebraska).

Family LEPORIDAE.

Lepus campestris (Prairie Hare).

(A) *Haemodipsus ventricosus* (Denny).

Lepus californicus.

(A) *Haemodipsus ventricosus* (Denny).

Order Insectivora.

Family TALPIDAE.

Scalops argentatus = *Scalopus acquaticus* (Mole).

(A) *Euhaematopinus abnormis* Osborn (Iowa).

Order Primates.

Family HOMINIDAE.

Homo sapiens.

(A) *Pediculus corporis* De Geer.

(A) *Pediculus capitis* De Geer.

(A) *Phthirus pubis* Linné.

From

HOST UNKNOWN.

(M) *Trichodectes painei* Kellogg & Nakayama, Psyche, vol. 21, pp. 90-92, fig. 1, (1914).